

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

VOITH PAPER GMBH & CO. KG

Plaintiff,

v.

JOHNSONFOILS, INC.

Defendant.

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Civil Action No. 07-226-JJF
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DEFENDANT, JOHNSONFOILS, INC.'S OPENING BRIEF IN SUPPORT OF ITS
MOTION FOR LEAVE TO AMEND ITS COUNTERCLAIMS

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Dated: December 21, 2007

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Defendant, JohnsonFoils, Inc., ("JohnsonFoils") hereby moves to amend its August 13, 2007 Counterclaims to add Declaratory Judgment Counterclaims that JohnsonFoils has not and does not infringe Plaintiff, Voith Paper GmbH & Co. KG's ("Voith") U.S. Patent No. 5,389,206 ("206 Patent" or "'206"), U.S. Patent No. 5,500,091 ("091 Patent" or "'091"); and U.S. Patent No. 5,853,544 ("544 Patent" or "'544"); and the '206, '091, and '544 Patents are invalid.¹

The proposed counterclaims are directly related to the current counterclaims, and their addition to this case is in the interest of judicial economy and will not prejudice Voith or delay this case.

I. NATURE AND STAGE OF PROCEEDINGS

On April 27, 2007, Voith filed this action alleging that JohnsonFoils infringed on U.S. Patent No. 5,718,805 ("805 Patent" or "'805"), and U.S. Patent No. 5,972,168 ("168 Patent" or "'168") (collectively referred to as "Patents-in-Suit"). JohnsonFoils served its Answer, Affirmative Defenses and Counterclaims on August 13, 2007. In its counterclaims, JohnsonFoils brought a claim for patent misuse and sought declaratory judgment that the Patents-in-Suit were not infringed and were invalid.

On August 24, 2007, JohnsonFoils filed Requests for Reexamination with the United States Patent and Trademark Office for the Patents-in-Suit.

¹ A copy of the proposed amended pleading showing the proposed additions and deletions is attached hereto as Exhibit A.

On September 5, 2007, Voith served its Answer to JohnsonFoils' Counterclaims.

Pursuant to the Court's August 3, 2007 Scheduling Order the trial is set to commence on November 5, 2008, and the parties, *inter alia*, were ordered to:

- (1) File all motions to amend the pleadings by December 21, 2007;
- (2) Attend a Markman hearing scheduled for January 30, 2008;
- (3) Complete exchange of contentions interrogatories, identify witnesses and complete document discovery by February 15, 2008; and
- (4) and complete fact discovery by April 30, 2008. (D.I. 17).

On August 28, 2007, JohnsonFoils filed a "Motion to Stay the Proceedings Pending Reexamination of the Patents-in-Suit or in the Alternative for Leave to File a Motion for Summary Judgment Prior to August 20, 2008 that U.S. Patents 5,718,805 and 5,972,168 are Invalid." (D.I. 27). Voith filed its response on September 17, 2007. JohnsonFoils' motion to stay remains pending. (D.I. 33)

On November 9, 2007, Voith filed its "Motion to Compel Defendant JohnsonFoils, Inc., to Provide Information Requested in Voith's First and Second Sets of Interrogatories and To Produce Documents Responsive to Voith's First and Second Set of Requests for Documents." (D.I. 42). JohnsonFoils filed its "Answering Brief to Plaintiff's Motion to Compel Defendant JohnsonFoils, Inc. to Provide Information Requested in Voith's First and Second Sets of Interrogatories and to Produce Documents Responsive to Voith's First and Second Requests for

Documents" on November 28, 2007. (D.I. 46). Voith then filed a further Reply Brief on December 3, 2007. (D.I. 48). Voith's motion to compel remains pending.

On December 17, 2007, JohnsonFoils filed "Defendant's Motion to Compel Production of Documents in Response to Its First Set of Document Requests." (D.I. 49). Voith's response to JohnsonFoils' motion is not due until January 7, 2008.

On December 18, 2007, Voith filed its "Motion for a Protective Order Pursuant to Federal Rule of Civil Procedure 26(c) Prohibiting the Disclosure of Voith's Highly Confidential Information to Individuals Engaged in Competitive Business Practices for or on Behalf of Voith's Competitor JohnsonFoils, Inc." (D.I. 52). JohnsonFoils' response to Voith's motion is not due until January 7, 2008.

II. SUMMARY OF ARGUMENT

JohnsonFoils' proposed amended counterclaims are directly related to its counterclaims in this action. Since JohnsonFoils acted timely within the period set in the Scheduling Order for amendment of pleadings, there has been no undue delay and there will be no prejudice to Voith by entry of the proposed amendments.

III. STATEMENT OF FACTS

Upon information and belief, the assignment records of the United States Patent and Trademark Office ("PTO") reflect ownership of the '805 Patent, the '168 Patent, the '206 Patent, the '091 Patent, and the '544 Patent (collectively referred to as "Voith's Twin Wire Former Patents") in the name of Voith. All of Voith's Twin

Wire Former Patents are a family of related patents concerning the same subject matter and claiming priority to a now abandoned application, Serial No. 07/773,965, which was filed as PCT/EP90/01313. See Exhibits B - F.

On November 28, 2007, JohnsonFoils filed a Complaint for Declaratory Judgment, Civil Action No. 07-769 ("Related Action"), that the '206, '091, and '544 Patents are invalid and unenforceable. See Exhibit G. When it filed the complaint, JohnsonFoils indicated that the matter was related to the instant action and the case was assigned to this Court.

On December 3, 2007, Voith refused JohnsonFoils' request to waive service of the Complaint for Declaratory Judgment (C.A. No. 07-769) and specifically instructed JohnsonFoils to serve Voith in accordance with the Hague Convention. See Exhibit H.

On December 17, 2007, JohnsonFoils sent a letter to Voith asking for consent to JohnsonFoils' request to amend counterclaims. Voith rejected JohnsonFoils' requests in a December 18, 2007 letter. See Exhibits I and J.

IV. ARGUMENT

A. JohnsonFoils Should Be Granted Leave to File An Amended Counterclaim.

Federal Rule of Civil Procedure Rule 15(a) provides that a party may amend its pleading after an answer has been filed only by leave of the court or by the written consent of the adverse party. Although the Third Circuit has adopted a liberal approach to the amendment of pleadings to ensure that "a particular claim

will be decided on the merits rather than on technicalities", the grant or denial of leave is within the Court's discretion. Dole v. Arco Chemical Co., 921 F.2d 484, 486-87 (3d Cir. 1990). Among the factors that may justify denial of leave to amend are: (1) undue delay, bad faith, or dilatory motives; (2) futility; or (3) prejudice to the other party. Foman v. Davis, 371 U.S. 178, 182, 83 S. Ct. 227, 9 L.Ed. 2d 222 (1962); Grayson v. Mayview State Hosp., 293 F.3d 103, 108 (3d Cir. 2002); Shipley v. Orndoff, 491 F. Supp. 2d 498, 509 (D. Del. 2007). Leave to amend is generally granted if the court cannot find an underlying circumstance that would render the amendment inappropriate. Arthur v. Maersk, Inc., 434 F.3d 196, 202 (3d Cir. 2006).

1. **Voith Cannot Demonstrate Undue Delay, Bad Faith, or Dilatory Motives.**

Delay by itself is not sufficient to justify denial of leave to amend. Arthur, 434 F.3d at 206. Voith cannot demonstrate undue delay in this case. The Court's Scheduling Order contemplates a December 21, 2007 deadline for filing amendments. Presumably, the Court set the deadline for amending pleadings with the expectation that the parties would be able to complete discovery and be ready for trial in November 2008. As such, JohnsonFoils' request to amend is *prima facie* reasonable. See Id. ("[A] period of eleven months from commencement of an action to the filing of a motion for leave to amend is not, on its face, so excessive as to be presumptively unreasonable.").

Moreover, JohnsonFoils' delay in moving to amend is reasonably explained. After JohnsonFoils filed its first Answer, Affirmative Defense and Counterclaims,

Voith asserted that any JohnsonFoils' twin wire former products that utilize resiliently mounted blades is an "Accused Product," infringe Voith's Twin Wire Former Patents. See Plaintiff's First Set of Interrogatories to JohnsonFoils, Inc. attached as Exhibit K on page 5. Based on this statement and other statements made to JohnsonFoils, it became apparent that Voith intends to use the existence of the other patents as a threat against JohnsonFoils regardless of the outcome of either the Reexamination proceedings or this action.

For that reason, JohnsonFoils brought the Related Action against Voith seeking a Declaratory Judgment that the '206 Patent, '091 Patent, and '544 Patent were not infringed and invalid.² As noted previously, all five of Voith's Twin Wire Former Patents are part of the same patent family and concern the same subject matter.

Since this action and the Related Action are related cases and Voith, as a German corporation, had already consented to jurisdiction in this district by bringing the instant action, JohnsonFoils assumed that Voith would agree to waiver service of process. After Voith refused to accept service, JohnsonFoils was left with the choice of moving to serve a foreign defendant under the Hague Convention, which would likely take many months and remove the possibility that the two cases could proceed on the same schedule, or to move to amend so that all of the issues

² JohnsonFoils filed the declaratory judgment action with the expectation that the action would be joined with this case and that the matters would be consolidated.

related to the same family of patents could be addressed concurrently. JohnsonFoils chose the latter in the interest of judicial economy.³

2. JohnsonFoils' Proposed Amendments Would Not Be Futile.

JohnsonFoils' proposed amendment cannot be found futile. In determining whether an amendment would be futile, the Court applies the same standard used in a motion to dismiss under Rule 12(b)(6) for failure to state a claim upon which relief may be granted. Cottman Transmission Sys., LLC v. Kershner, 492 F. Supp. 2d 461, 465 (D. Pa. 2007), also see McGreevy v. Stroup, 413 F.3d 359, 371 (3d Cir. 2005). Here, the causes of action for declaratory judgment of non-infringement and invalidity of the '206, '091, and '544 Patents that JohnsonFoils seeks to add to this action are essentially identical to JohnsonFoils' existing counterclaims. Since Voith did not move to dismiss those counterclaims, it does not appear that there is any basis to dismiss the proposed counterclaims under Rule 12(b)(6).

3. JohnsonFoils' Proposed Amendments Would Not Prejudice Voith.

Voith cannot be prejudiced by JohnsonFoils' proposed amended counterclaims which are directly related to JohnsonFoils' existing counterclaims as they do not add an unexpected, substantially different, or unrelated legal theory. See Arthur, 434 F.3d at 204. In essence, JohnsonFoils seeks a declaration of non-infringement for the same accused products and seeks to invalidate the Voith Family of Patents using the same prior art.

³ If the instant motion is granted, JohnsonFoils plans to dismiss the Related Action.

In addition, since the issues in both cases surround the infringement and validity of Voith's Twin Wire Former Patents, most of the relevant information and documents are already in Voith's possession, custody or control. To the extent Voith requires discovery of JohnsonFoils, Voith has already served JohnsonFoils with extremely broad discovery that encompasses any product that could be covered by Voith's Twin Wire Former Patents.⁴ See Exhibits L and M. Although JohnsonFoils' has not yet received any of the documents it requested in August 2007, its document requests relate to the subject matter of all of Voith's Twin Wire Former Patents. See Exhibit N. Therefore, there is no additional burden to Voith in terms of document production. Moreover, Voith has almost two months until February 15, 2008 to serve additional interrogatories and documents requests, if needed, and over four months to April 30, 2008 in which to depose witnesses for a November 2008 trial.

Clearly, the case before the Court is not so far advanced or so costly to Voith that permitting an amendment could be seen as undue prejudice.

⁴ JohnsonFoils has already produced 50,524 pages of documents. By contrast, JohnsonFoils has yet to receive a single document that its attorneys could review.

V. CONCLUSION

For the foregoing reasons, JohnsonFoils respectfully requests that leave be granted to file its amended counterclaims.

Respectfully submitted,

/s/ Patricia P. McGonigle

Dated: December 21, 2007

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CERTIFICATE OF SERVICE

I, Patricia P. McGonigle, Esquire, hereby certify that on this 21st day of December 2007, I electronically filed the foregoing pleading with the Clerk of Court using CM/ECF which will send notification of such filing to counsel of record. Further, I caused a copy of the foregoing to be served upon the following counsel as noted

Via Hand Delivery

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EXHIBIT A

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

VOITH PAPER GMBH & CO. KG,	:	
	:	
	:	
Plaintiff,	:	
	:	C.A. No. 07-226-UNA
v.	:	
	:	
JOHNSONFOILS, INC.,	:	
	:	
Defendant.	:	

**DEFENDANT, JOHNSONFOILS, INC.'S, ANSWER, AFFIRMATIVE
DEFENSES, AND AMENDED COUNTERCLAIMS TO PLAINTIFF,
VOITH PAPER GMBH & CO. KG'S, COMPLAINT**

Defendant, JohnsonFoils, Inc. ("JohnsonFoils"), by and through its undersigned counsel, hereby responds to the allegations in Plaintiff, Voith Paper GmbH & Co. KG's ("Voith"), Complaint as follows, and asserts the following Affirmative Defenses and Counterclaims.

1. Denied.
2. JohnsonFoils is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph and denies the same.
3. Admitted.
4. Denied.
5. Denied.
6. Denied.
7. Denied as a conclusion of law; however, it is admitted that JohnsonFoils is a Delaware corporation.

8. Denied.

9. Denied as conclusions of law to which no responsive pleading is required.

10. Denied as conclusions of law to which no responsive pleading is required.

11. Denied as conclusions of law to which no responsive pleading is required.

12. Denied as conclusions of law to which no responsive pleading is required.

13. Denied as conclusions of law to which no responsive pleading is required.

14. Denied as stated. It is admitted that formation is a part of the paper making process.

15. JohnsonFoils is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph and denies the same.

16. JohnsonFoils is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph and denies the same.

17. Denied as conclusions of law to which no responsive pleading is required.

18. To the extent the paragraph is understood, it is denied; however, it is admitted that JohnsonFoils is engaged in designing and building improved drainage devices.

19. Denied.

20. Denied.

21. Paragraph 21 of Voith's Complaint is a transitional paragraph to which no response is required.

22. Denied.

23. Denied.

24. Denied.

25. Denied.

26. Denied.

JohnsonFoils further denies that Voith is entitled to any of the relief requested in its Prayer for Relief.

AFFIRMATIVE DEFENSES

First Affirmative Defense

Voith fails to state a claim upon which relief can be granted.

Second Affirmative Defense

JohnsonFoils has not infringed any claim of the Patents-in-Suit, either literally or under the doctrine of equivalents.

Third Affirmative Defense

Each of the Patents-in-Suit is invalid, unenforceable, and void for failure to comply with the provisions of 35 U.S.C. § 101 *et seq.*

Fourth Affirmative Defense

Voith is barred by the doctrine of Prosecution History Estoppel from presenting a claim interpretation necessary to find infringement of any claim of the Patents-in-Suit.

Fifth Affirmative Defense

Voith has misused each of the Patents-in-Suit which renders each of them unenforceable, and Voith is precluded from obtaining any relief in this action due to its misuse.

Sixth Affirmative Defense

Voith's claims are barred, in whole or in part, by the doctrine of equitable estoppel.

Seventh Affirmative Defense

Voith's claims are barred, in whole or in part, by the doctrine of waiver.

Eighth Affirmative Defense

Voith's claims are barred, in whole or in part, by the statute of limitations.

Ninth Affirmative Defense

Voith's claims are barred, in whole or in part, by the doctrine of laches.

COUNTERCLAIMS

Defendant and Counterclaimant, JohnsonFoils, Inc. ("JohnsonFoils"), hereby asserts the following counterclaims against Voith:

Parties

1. Upon information and belief, Plaintiff and Counterclaim Defendant, Voith Paper GmbH & Co. KG's ("Voith"), is a corporation organized and existing under the laws of Germany, with its principal place of business at Sankt Poeltener Strasse 43, Heidenheim, Germany 89522.

2. Defendant and Counterclaimant, JohnsonFoils, is a corporation organized and existing under the laws of the State of Delaware.

3. Defendant and Counterclaimant, JohnsonFoils has its principal place of business located at 40 Progress Avenue, Springfield, MA 01104.

Jurisdiction and Venue

4. Voith has invoked the jurisdiction and venue of this Court by filing its Complaint arising out of the same subject matter as JohnsonFoils' counterclaims.

5. Jurisdiction arises under 28 U.S.C. §§ 1331, 1338, 1367, 2201 and 2202.

6. Venue is proper in this District under 28 U.S.C. §§ 1391 and 1400.

Background

7. JohnsonFoils is in the business of researching, designing and developing drainage equipment, cleaning systems, ceramic products and technology for the management of water removal and sheet formation on pulp and paper machines.

8. [U.S. Patent No. 5,389,206 \("206 Patent"\) issued on February 14, 1995, for a "TWIN WIRE FORMER". A copy of the '206 Patent is attached as Exhibit "A."](#)

9. U.S. Patent No. 5,500,091 ("091 Patent") issued on March 19, 1996, for a "TWIN WIRE FORMER". A copy of the '091 Patent is attached as Exhibit "B."

10. U.S. Patent No. 5,853,544 ("544 Patent") issued on December 29, 1998 for a "TWIN WIRE FORMER". A copy of the '544 Patent is attached as Exhibit "C."

11. U.S. Patent No. 5,718,805 ("805 Patent") issued on February 17, 1998 for a "TWIN WIRE FORMER". A copy of the '805 Patent is attached as Exhibit "D."

12. U.S. Patent No. 5,972,168 ("168 Patent") issued on December 29, 1998 for a "TWIN WIRE FORMER". A copy of the '168 Patent is attached as Exhibit "E."

13. Upon information and belief, the assignment records of the United States Patent and Trademark Office ("PTO") reflect ownership of the '805 Patent, the '168 Patent, the '206 Patent, the '091 Patent, and the '544 Patent (collectively referred to as "Voith's Twin Wire Former Patents") in the name of Voith.

14. The Voith's Twin Wire Former Patents are a single family of related patents that share a common detailed description of the preferred embodiments and the same claim of priority to application Serial No. 07/773,965, filed as PCT/EP90/01313, which is now abandoned.

15. ~~8.~~ On April 27, 2007, Voith filed a Complaint in the United States District Court for the District of Delaware, C.A. No. 07-02226-JJF, alleging that JohnsonFoils infringed the '805 and '168 Patents-in-Suit. ("Patents-in-Suit").

~~9. U.S. Patent Nos. 5,718,805 ('805 Patent) and 5,972,168 ('168 Patent), (collectively hereinafter the "Patents-in-Suit") were attached as Exhibits "1" and "2" to Voith's Complaint.~~

16. On August 24, 2007, JohnsonFoils filed requests for reexamination with the PTO for the Patents-in-Suit.

17. On November 16, 2007 JohnsonFoils filed requests for reexamination with the PTO for the '206; '091; and, '544 Patents.

18. Voith asserts that any JohnsonFoils twin wire former product that utilizes a resiliently mounted blade is an "Accused Product" (see the definition of "Accused Product," on page 5 of Plaintiff's [Voith] First Set of Interrogatories to JohnsonFoils, Inc., Exhibit "F" to this Complaint) and it infringes Voith's Twin Wire Former Patents.

19. There is a substantial and continuing justiciable controversy between Voith and JohnsonFoils regard JohnsonFoils' right to manufacture and sell twin wire formers having a resiliently mounted blade in view of Voith's Twin Wire Former Patents.

First Counterclaim
Declaratory Judgment of Non-Infringement of the Patents-in-Suit

20. ~~10.~~ The allegations in Paragraphs 1-19 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

21. ~~11.~~ An actual controversy requiring a declaration of rights by this Court exists under the Patent Act between JohnsonFoils and Voith concerning the alleged infringement and the invalidity of the Patents-in-Suit.

22. ~~12.~~ JohnsonFoils' counterclaim for declaratory relief is brought pursuant to the Declaratory Judgment Act, 28 U.S.C. §§ 2201, *et seq.* and 35 U.S.C. §§ 1, *et seq.*

23. ~~13.~~ JohnsonFoils has not and does not infringe, literally or under the doctrine of equivalents, any claim of the Patents-in-Suit.

24. ~~14.~~ JohnsonFoils has not induced and is not inducing infringement of any claim of the Patents-in-Suit.

25. ~~15.~~ JohnsonFoils' has not in the past and is not now contributing to the infringement of any claim of the Patents-in-Suit.

26. ~~16.~~ JohnsonFoils is entitled to a declaratory judgment that it has not in the past infringed and is not now infringing any claim of the Patents-in-Suit.

Second Counterclaim
Declaratory Judgment that the Patents-in-Suit Are Invalid

27. ~~17.~~ The allegations in Paragraphs 1-16 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

28. ~~18.~~ All claims of the Patents-in-Suit are invalid under 35 U.S.C. § 102.

29. ~~19.~~ All claims of the Patents-in-Suit are invalid under 35 U.S.C. § 103.

30. ~~20.~~ All claims of the Patents-in-Suit are invalid under 35 U.S.C. § 112.

31. ~~21.~~ JohnsonFoils is entitled to a declaratory judgment that the all claims of the Patents-in-Suit are invalid, unenforceable, and void pursuant to 35 U.S.C. §§ 101 *et seq.*

Third Counterclaim

Declaratory Judgment of Non-Infringement of the '206 Patent

32. The allegations in Paragraphs 1-19 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

33. An actual controversy requiring a declaration of rights by this Court exists under the Patent Act between JohnsonFoils and Voith concerning the alleged infringement and the invalidity of the '206 Patent.

34. JohnsonFoils' counterclaim for declaratory relief is brought pursuant to the Declaratory Judgment Act, 28 U.S.C. §§ 2201, *et seq.* and 35 U.S.C. §§ 1, *et seq.*

35. JohnsonFoils has not and does not infringe, literally or under the doctrine of equivalents, any claim of the '206 Patent.

36. JohnsonFoils has not induced and is not inducing infringement of any claim of the '206 Patent.

37. JohnsonFoils' has not in the past and is not now contributing to the infringement of any claim of the '206 Patent.

38. JohnsonFoils is entitled to a declaratory judgment that it has not in the past infringed and is not now infringing any claim of the '206 Patent.

Fourth Counterclaim

Declaratory Judgment of Non-Infringement of the '091 Patent

39. The allegations in Paragraphs 1-26 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

40. An actual controversy requiring a declaration of rights by this Court exists under the Patent Act between JohnsonFoils and Voith concerning the alleged infringement and the invalidity of the '091 Patent.

41. JohnsonFoils' counterclaim for declaratory relief is brought pursuant to the Declaratory Judgment Act, 28 U.S.C. §§ 2201, *et seq.* and 35 U.S.C. §§ 1, *et seq.*

42. JohnsonFoils has not and does not infringe, literally or under the doctrine of equivalents, any claim of the '091 Patent.

43. JohnsonFoils has not induced and is not inducing infringement of any claim of the '091 Patent.

44. JohnsonFoils' has not in the past and is not now contributing to the infringement of any claim of the '091 Patent.

45. JohnsonFoils is entitled to a declaratory judgment that it has not in the past infringed and is not now infringing any claim of the '091 Patent.

Fifth Counterclaim
Declaratory Judgment of Non-Infringement of the '544 Patent

46. The allegations in Paragraphs 1-33 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

47. An actual controversy requiring a declaration of rights by this Court exists under the Patent Act between JohnsonFoils and Voith concerning the alleged infringement and the invalidity of the '544 Patent.

48. JohnsonFoils' counterclaim for declaratory relief is brought pursuant to the Declaratory Judgment Act, 28 U.S.C. §§ 2201, *et seq.* and 35 U.S.C. §§ 1, *et seq.*

49. JohnsonFoils has not and does not infringe, literally or under the doctrine of equivalents, any claim of the '544 Patent.

50. JohnsonFoils has not induced and is not inducing infringement of any claim of the '544 Patent.

51. JohnsonFoils' has not in the past and is not now contributing to the infringement of any claim of the '544 Patent.

52. JohnsonFoils is entitled to a declaratory judgment that it has not in the past infringed and is not now infringing any claim of the '544 Patent.

Sixth Counterclaim
Declaratory Judgment that the '206 Patent Is Invalid

53. The allegations in Paragraphs 1-54 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

54. All claims of the '206 Patent is invalid under 35 U.S.C. § 102.

55. All claims of the '206 Patent is invalid under 35 U.S.C. § 103.

56. All claims of the '206 Patent is invalid under 35 U.S.C. § 112.

57. JohnsonFoils is entitled to a declaratory judgment that the all claims of the '206 Patent is invalid, unenforceable, and void pursuant to 35 U.S.C. §§ 101 *et seq.*

Seventh Counterclaim
Declaratory Judgment that the '091 Patent Is Invalid

58. The allegations in Paragraphs 1-59 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

59. All claims of the '091 Patent is invalid under 35 U.S.C. § 102.

60. All claims of the '091 Patent is invalid under 35 U.S.C. § 103.

61. All claims of the '091 Patent is invalid under 35 U.S.C. § 112.

62. JohnsonFoils is entitled to a declaratory judgment that the all claims of the '091 Patent is invalid, unenforceable, and void pursuant to 35 U.S.C. §§ 101 *et seq.*

Eighth Counterclaim
Declaratory Judgment that the '544 Patent Is Invalid

63. The allegations in Paragraphs 1-64 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

64. All claims of the '544 Patent is invalid under 35 U.S.C. § 102.

65. All claims of the '544 Patent is invalid under 35 U.S.C. § 103.

66. All claims of the '544 Patent is invalid under 35 U.S.C. § 112.

67. JohnsonFoils is entitled to a declaratory judgment that the all claims of the '544 Patent is invalid, unenforceable, and void pursuant to 35 U.S.C. §§ 101 *et seq.*

Ninth Counterclaim
Patent Misuse

68. ~~22.~~ JohnsonFoils incorporates paragraphs 1-~~21~~ 67of its Counterclaims as if fully set forth herein.

69. ~~23.~~ On information and belief, Voith has misused the Patents-in-Suit by filing the present action against JohnsonFoils for patent infringement when Voith knew or should have known that JohnsonFoils was not infringing any permissible, reasonable or valid interpretation of any claim of the Patents-in-Suit.

70. ~~24.~~ On information and belief, Voith's impermissible, unreasonable or invalid interpretations of the claims of the Patents-in-Suit are interposed for the purposes of this suit and its anti-competitive effect.

71. ~~25.~~ On information and belief, Voith knew or should have known of existing prior art that was not before the United States Patent and Trademark Office during the prosecution of the applications leading to the Patents-in-Suit.

72. ~~26.~~ On information and belief, that existing prior art is such that Voith knew or should have known that the claims of the Patents-is-Suit were not patentable.

73. ~~27.~~ On information and belief, that existing prior art is such that Voith now knows or should have known that its interpretations of the claims of the Patents-in-Suit render them invalid.

74. ~~28.~~ On information and belief, Voith knowingly ignored the existing prior art so it could advance its impermissible, unreasonable or invalid

interpretations of the claims of the Patents-in-Suit and use them as a jurisdictional basis for this sham suit and its anti-competitive effects.

75. ~~29.~~ Voith's assertion of impermissible, unreasonable or invalid interpretations of the claims of the Patents-in-Suit is having an anti-competitive effect on JohnsonFoils.

RELIEF

WHEREFORE, JohnsonFoils requests that this Court enter a judgment that:

(a) Dismisses Voith's Complaint with prejudice and denies all of the relief it requested therein;

(b) Voith and all persons in active concert or participation with it are enjoined from threatening or charging JohnsonFoils, its suppliers, customers or distributors with infringement of U.S. Patent Nos. 5,389,206, 5,500,091, 5,853,544, 5,718,805 and 5,972,168;

(c) JohnsonFoils its suppliers, customers and distributors are not liable for any infringement of U.S. Patent Nos. 5,389,206, 5,500,091, 5,853,544, 5,718,805 and 5,972,168;

(d) That U.S. Patent Nos. 5,389,206, 5,500,091, 5,853,544, 5,718,805 and 5,972,168 are invalid, unenforceable, and void pursuant to 35 U.S.C. §§ 101 *et seq.*;

(e) That Voith is not entitled to costs pursuant to 35 U.S.C. § 288;

(f) Awards JohnsonFoils damages arising out of Voith's misuse of U.S. Patent Nos. 5,389,206, 5,500,091, 5,853,544, 5,718,805 and 5,972,168;

(g) This is an exceptional case entitling JohnsonFoils to an award of its attorneys' fees and costs pursuant to 35 U.S.C. § 285;

(h) That JohnsonFoils is entitled to prejudgment interest and post-judgment interest on the above damages awards; and

(i) Such other and further relief as this Court may deem appropriate.

JURY TRIAL DEMAND

A trial by jury is demanded.

Respectfully submitted,

Dated: _____

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EXHIBIT B

United States Patent [19][11] **Patent Number:** **5,718,805****Egelhof et al.**[45] **Date of Patent:** ***Feb. 17, 1998**[54] **TWIN WIRE FORMER**

[75] Inventors: **Dieter Egelhof**, **Klaus Henseler**, both of Heidenheim, Germany; **Werner Kade**, Neenah, Wis.; **Albrecht Meinecke**, Heidenheim, Germany; **Wilhelm Wanke**, Heidenheim, Germany; **Hans-Jurgen Wulz**, Heidenheim, Germany; **Rudolf Bück**, deceased, late of Heidenheim, Germany, by **Else Bück**, legal representative

[73] Assignee: **J. M. Voith GmbH**, Heidenheim, Germany

[*] Notice: The term of this patent shall not extend beyond the expiration date of Pat. No. 5,500,091.

[21] Appl. No.: **556,769**[22] Filed: **Nov. 2, 1995****Related U.S. Application Data**

[63] Continuation of Ser. No. 286,948, Aug. 8, 1994, Pat. No. 5,500,091, which is a continuation of Ser. No. 55,918, Apr. 29, 1993, Pat. No. 5,389,206, which is a continuation of Ser. No. 773,965, filed as PCT/EP90/01313, Sep. 8, 1990, abandoned.

[30] **Foreign Application Priority Data**

Aug. 22, 1989 [DE] Germany 39 27 597.3

[51] Int. Cl.⁶ **D21F 1/00**

[52] U.S. Cl. **162/301; 162/300**

[58] Field of Search 162/203, 300, 162/301, 303, 348, 352

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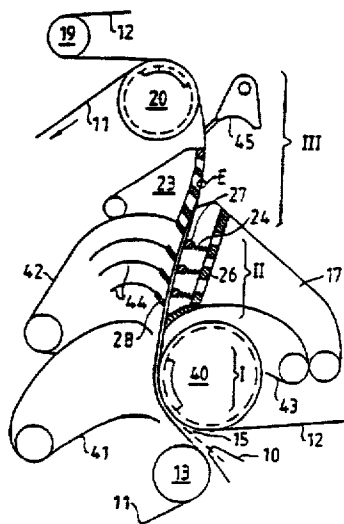
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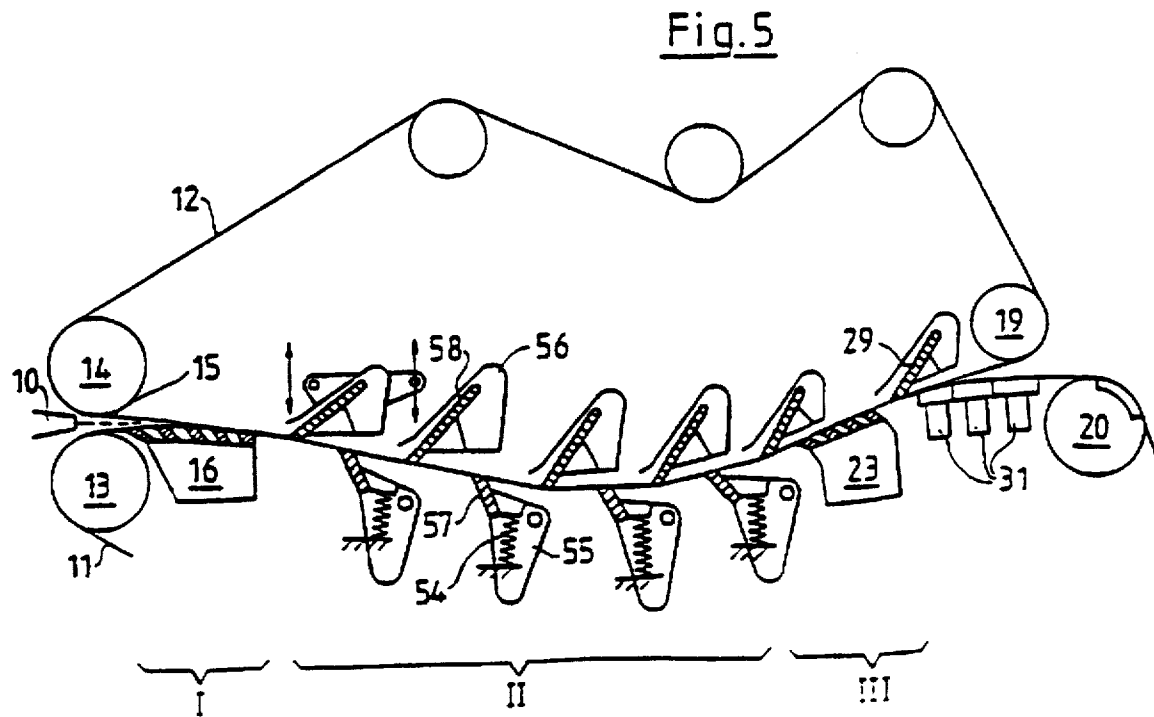
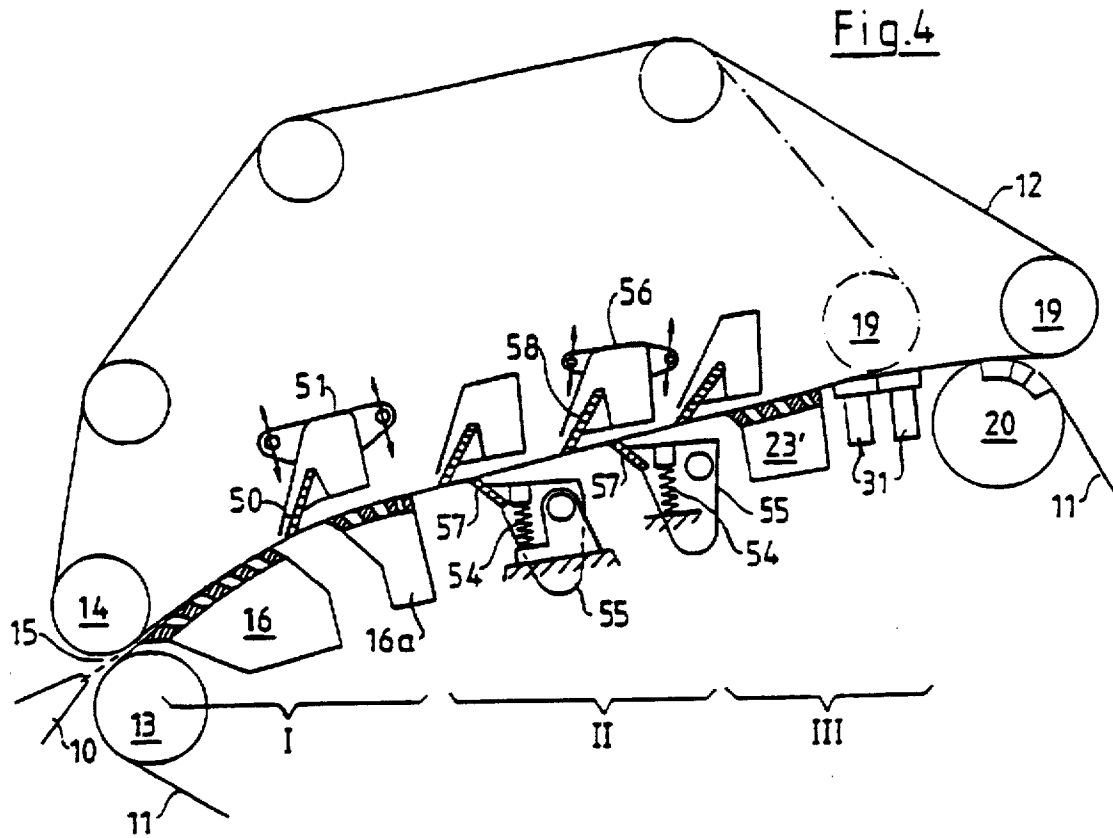
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[57]

ABSTRACT

In a twin-wire former for the production of a paper web, two wire belts (11 and 12) together form a twin-wire zone which is divided into three sections (I, II and III). In the first section (I) the two wires (11, 12) travel over a curved forming shoe (16), or a forming roll (40). They form there a wedge-shaped inlet slot (15) with which a headbox (10) is directly associated. In the second section (II), several resiliently supported strips (27) rest against the lower wire (11) and between each of said strips (27) a rigidly mounted strip (28) rests against the upper wire (12). In the third section (III) both wire belts (11, 12) pass over another curved forming shoe (23).

5 Claims, 2 Drawing Sheets



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TWIN WIRE FORMER**RELATED APPLICATIONS**

This is a continuing application of, and hereby incorporates by reference the entire disclosure of, application Ser. No. 08/286,948, filed Aug. 8, 1994 now U.S. Pat. No. 5,500,091, which is a continuing application Ser. No. 08/055,918, filed Apr. 29, 1993, issued Feb. 14, 1995 as U.S. Pat. No. 5,389,206, which is a continuing application Ser. No. 07/773,965, filed as PCT/EP90/01313 Sep. 8, 1990, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to a twin-wire former for the production of a fiber web, in particular a paper web, from a fiber suspension. The invention proceeds from the basis of the twin-wire former known from British Patent 1 125 906. The features indicated in the patent include a twin wire former for producing a fiber web and particularly a paper web from a fiber suspension. Two web forming wire belts, in the form of endless loops, travel together to form a twin wire zone. The web travels between and along the path of the wire belts through the twin wire zone. The twin wire zone has three sections and the elements in those three sections are described below. The patent describes features that state, in other words, that the forming of the fiber web from the pulp suspension fed from the headbox takes place exclusively between two wire belts. Thus, there is no so-called single-wire pre-drainage path. In a first section of the twin-wire zone, the two wire belts together form a wedge-shaped inlet slot; a jet of pulp slurry coming from the headbox discharges into it. The jet strikes the two wire belts at a place where they pass over a curved drainage element; in the case of the aforementioned British patent, this is a stationary, curved forming shoe. Its curved wire guide surface is formed of a plurality of strips with drainage slots between them. This forming shoe is followed (in a second section of the twin-wire zone) by a drainage strip arranged in the other wire loop and, behind the latter, by a drainage strip arranged in the first-mentioned wire loop (and formed by a first suction box). Finally, in a third section of the twin-wire zone there are a plurality of stationary drainage elements developed as flat suction boxes.

It has been attempted for decades with twin-wire formers of the known type to produce fiber webs (in particular, paper webs) of the highest possible quality with relatively high operating speeds. Due to the forming of the web between two wires, the result, in particular, is obtained that the final fiber web has substantially the same properties on both sides (little "two-sidedness"). However, it is difficult to obtain as uniform as possible a distribution of the fibers in the final fiber web. In other words, it is difficult to obtain a good "formation" since while the web is formed, there is always the danger that fibers will agglomerate and form flocculations. Therefore, it is attempted to form a jet of pulp slurry which pulp slurry is as free as possible of flocculations in the headbox (for instance, by means of a turbulence producer). It is, furthermore, endeavored so to influence the drainage of the fiber suspension during the web-forming that "reflocculation" is avoided as far as possible or that, after possible flocculation, a "deflocculation" (i.e. a breaking up of the flocculations) takes place.

It is known that a curved drainage element arranged in the first section of the twin-wire zone and, in particular, a stationary curved forming shoe developed in accordance with the aforementioned British Patent 1 125 906 counter-

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acts the danger of reflocculation. This is true also of the drainage strips arranged in the British patent in the second section of the twin-wire zone. Nevertheless, the danger of reflocculation is not completely eliminated in the arrangement according to said British patent. Since the number of drainage strips there is very small, a large part of the web-forming takes place in the region of the following flat-suction boxes. They, to be sure, are of high drainage capacity so that the web-forming can be completed in the region of the last flat suction boxes (i.e. the so-called main drainage zone, in which a part of the fiber material is still in the form of a suspension, terminates in the region of the flat suction box). The flat suction boxes, however, are not able to avoid reflocculation or to break up flocculations which have already occurred.

In order to control these last-mentioned difficulties, a web-forming device known under the name of "Duoformer D" has been developed (TAPPI proceedings 1988 annual meeting, pages 75 to 80). This known web-forming device is part of a twin-wire former which has a single-wire pre-drainage zone. In the twin-wire zone there are provided, in the one wire loop, a plurality of strips which are fixed in position but adjustably supported, namely, on the bottom of a suction box which drains in upward direction. Furthermore, a plurality of resiliently supported strips are provided in the other wire loop. By this resilience of the last-mentioned strips, the following result can be obtained: For example, upon an increase of the amount of suspension entering between the two wire belts, the flexibly supported strips can move away somewhat. In this way, the danger (which is present when only firmly supported strips are used) is eliminated of a backing up taking place in the fiber suspension in front of the strips. Such a backing up could destroy the fiber layers which have been formed up to then on the two wire belts. In other words, with this known web-forming device, a drainage pressure, once established, remains constant due to the resiliently supported strips even upon a change in the amount of suspension fed or upon a change in the drainage behavior of the fiber suspension. Therefore, automatic adaptation of the web-forming device to said changed conditions occurs.

With this known web-forming device, fiber webs of relatively good formation can also be formed. With respect to this, however, the demands have increased considerably recently, so that further improvements are desirable.

SUMMARY OF THE INVENTION

The object of the invention is so to develop a twin-wire of the aforementioned kind that the quality of the fiber web produced is further improved, particularly with respect to its formation (cloudiness), and that the twin-wire former can easily be adapted to different operating conditions (for instance, with regard to quantity and drainage behavior of the fiber suspension).

This object is achieved by the features set forth below. In particular, there is a respective drainage strip above each of the two wire belts in the second section of the twin wire zone, and at least one of the two drainage strips is supported resiliently against the respective wire belt while the other may or may not be resiliently supported, and typically is rigidly supported against the respective wire belt. Preferably, there are at least two of the drainage strips and often more against each of the wire belts. The drainage strips against one belt are offset along the path of the wire belts with respect to the drainage strips against the other belt, providing a zig zag or staggered array, and the drainage strips against at least one of the belts are resiliently supported.

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The inventors have found that a combination of known features, namely:

- A. Twin-wire former without a single-wire pre-drainage zone or at least without a single-wire pre-drainage zone of any substantial length such as to cause any appreciable pre-drainage
- B. Start of the drainage in the twin-wire zone at a preferably curved drainage element, for instance on a rotating forming cylinder or, even better, on a curved stationary forming shoe
- C. Further drainage in the twin-wire zone between strips which are arranged along a "zig-zag" line, the strips which rest against the one wire belt being resiliently supported.

leads to an extremely high increase in the quality of the finished fiber web, so that it satisfies even the highest requirements. At the same time, the twin-wire former of the invention is insensitive to changes in the amount of suspension fed and to changes in the drainage behavior of the fiber suspension. Experiments have shown that it is possible by the invention to obtain both a high increase in quality with respect to the formation and also good values with regard to the retention of fillers and fines. In contradistinction to this, in the known double-wire formers it is constantly found that there is a strong reduction in the retention upon an improvement in the formation.

It was, furthermore, found in experiments that in the second section of the twin-wire zone the number of strips can be considerably reduced as compared with the "Duo-former D". However, this number is substantially greater than in the case of the twin-wire former known from British Patent 1 125 906. It is advantageous to increase the distance between adjacent strips as compared with the "Duo-former D". In particular, the drainage strips above each one of the wire belts are of a thickness along the path of the wire belts and the spacing between adjacent strips above each wire belt is a minimum of about three times the strip thickness.

To be sure, from German OS 31 38 133, FIG. 3, a twin-wire former is known the twin-wire zone of which is provided in a first section with a curved stationary drainage element and in a second section with strips arranged along a "zig-zag" line, which strips may also be resiliently supported and there being a relatively large distance between them. However, in that case, in front of the twin-wire zone there is a single-wire pre-drainage zone in which the forming of the web starts initially only in a lower layer of the fiber suspension fed while the upper layer remains liquid and tends very strongly to flocculation. It has been found that these flakes cannot be broken up again to the desired extent in the following twin-wire zone. Another disadvantage is that the twin-wire zone is diverted by a guide roll (14b) behind the second section. This results (due to the so-called table-roll effect) in a further drainage which is uneven over the width of the web and thus in undesired variations in the quality of the web (recognizable, for instance, by disturbing longitudinal stripes).

BRIEF DESCRIPTION OF THE DRAWINGS

Other developments of the invention will be explained below with reference to embodiments which are shown in the drawing. Each of FIGS. 1 to 5 shows in simplified diagrammatic form one of the different embodiments.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The twin-wire former shown in FIG. 1 has a substantially horizontally extending twin-wire zone; this zone comprises

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three sections I, II and III arranged one behind the other. The endless wire belts (lower wire 11 and upper wire 12), shown only in part, travel in the direct vicinity of a headbox 10 over, in each case, a breast roll 13 and 14 respectively, so that the two wire belts together form a wedge-shaped entry slot 15 at the start of the twin-wire zone. The jet pulp discharged by the headbox 10 comes into contact with the two wire belts 11 and 12 only at the place where the lower wire 11 in the first section I of the twin-wire zone travels over a stationary curved forming shoe 16. The curved travel surface thereof is formed of several strips 16' with drainage slits present between them. The distance between the two breast rolls 13 and 14 is variable. The forming shoe 16 can be operated with or without vacuum. Additionally, although it is preferable that the forming shoe 16 be curved, a straight forming shoe may also be used in certain situations.

In the second section II of the twin-wire zone, the two wire belts 11 and 12 (with the partially still liquid fiber suspension present between them) travel between a lower drainage box 17 and an upper drainage box 18. In the lower drainage box 17 there are a row of at least two strips 27 (preferably of approximately rectangular cross section) which are pressed from below resiliently against the lower wire 11. For this purpose, they are supported, for instance, on springs 24 (or pneumatic pressure cushions) on a, preferably water-permeable, plate. It is obvious that the force of the springs (or of the pressure prevailing in the pressure cushions) is individually adjustable.

The upper drainage box 18 is suspended on both the front and rear ends on vertically displaceable support elements as indicated diagrammatically by double arrows. On its lower side, there is a row of at least three strips 28 of preferably parallelogram cross section which rest against the upper side of the upper wire 12 and are rigidly attached to the box 18. Above the strips 28, a front vacuum chamber 21 and a rear vacuum chamber 22 are present in the drainage box 18.

Each of the upper strips 28 scrapes off water from the wire 12. Accordingly, the amount of water scraped off decreases in the direction of flow of the wire 12 from strip to strip. The drainage water from each of the strips 28 except the drainage water scraped off by the first strip may be drained away jointly. However, it is disadvantageous to also include the drainage water from the first strip 28 since this generally would disturb the operation of the other strips. Accordingly, a vertical channel 21a is positioned in front of the first upper strip 28 to carry away or collect the water scraped off by the first strip 28.

In the region of the forming shoe 16, a part of the water of the fiber suspension is led off downward; another part penetrates due to the tension of the upper wire 12-upwards through the upper wire and is deflected by the furthest in front of the strips 28 into the front vacuum chamber 21. The water passing upward between the upper strips 28 enters into the rear vacuum chamber 22. The water penetrating between the lower strips 27 through the lower wire 11 is led off downward. Between adjacent upper drainage strips 28 there is a minimum distance X of about three times the thickness Y of the strips. The same is true of the lower resiliently supported strips 27. It is important that each of the strips 27 and 28 lies in the region of a space between two opposite strips so that a "zig-zag" arrangement (i.e. non-opposing relationship) is present. Also, as seen in FIG. 1, the first one of the strips 28 is located upstream of the first one of the strips 27. The two wires 11 and 12 preferably travel on a straight path through section II. Gentle curvature of this section of the path is, however, also possible; see FIGS. 2 and 5. Differing from FIG. 1, the resiliently supported strips

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could also be arranged in the upper box 18 and the firmly supported strips in the lower box 17. In the third section III of the twin-wire zone, both wire belts 11 and 12 travel over another preferably curved forming shoe 23 which (as shown) is arranged preferably in the lower wire loop 11. Behind it, an additional strip 29 with vacuum chamber 30 can be arranged in the loop of the upper wire 12. Furthermore, flat suction boxes 31 can be present in the loop of the lower wire. There (as is shown by dash-dot lines) the upper wire 12 can be separated by means of a guide roll 19 from the lower wire 11 and from the fiber web formed. Lower wire and fiber web then travel over a wire suction roll 20. The guide roll 19 can, however, also lie further back, so that the upper wire 12 is separated from the lower wire 11 only on the wire suction roll 20.

It is important that two drainage boxes 17 and 18 with the alternately resiliently and firmly supported ledge strips 27 and 28 lie not in the front or the rear sections but in the middle section II of the twin-wire zone, since only here can they develop their full effect, namely, intensive drainage of the fiber suspension fed while retaining the fine flocculation-free fiber distribution. This is achieved in the manner that the corresponding wire belt is imparted a slight (scarcely visible) deflection on each strip so that turbulence is constantly produced in the still liquid part of the fiber pulp. For success it is, however, also decisive that previously, in section I, a known pre-drainage towards both sides has already taken place and that this also takes place with the greatest possible retention of the flocculation-free condition of the fiber suspension.

For this two-sided pre-drainage, a stationary preferably curved forming shoe is provided in the first section I of the twin-wire zone (in accordance with FIGS. 1 and 3-5) whenever it is a question of satisfying the highest quality demands with respect to the formation. This effect of the forming shoe is due to the fact that at least the one wire belt travels polygonally from strip to strip, each strip not only leading water away but also producing turbulence in the pulp which is still liquid. With such a forming shoe, it is, however, difficult at times to obtain a stable operating condition upon the starting of the paper machine. Therefore, it may be advantageous to provide a known forming roll 40 in accordance with FIG. 2 in Section I instead of the stationary forming shoe and the breast roll lying in front of it. This possibility will be utilized when, in particular, the highest productivity is demanded from the paper manufacturing machine.

In the third section III, the aforementioned strip 29 can serve either solely to lead away water upwards or, in addition, for the further production of turbulence (for further improvement in quality). The latter is possible if a part of the fiber pulp is still in liquid condition at this place.

In FIGS. 1 to 3, the distance between the two wires 11 and 12 in the twin-wire zone has been shown greatly exaggerated. By this, it is intended to make it clear that the two wires 11 and 12 converge towards each other over a relatively long path within the twin-wire zone. This makes it clear that the process of web-forming on the first forming shoe 16 (in Section I) commences relatively slowly and is completed only in Section III. In this connection, the end of the main drainage zone in which the two wires converge towards each other (and thus, the end of the web-forming process) can lie approximately in the center of the wrapping zone of the second forming shoe 23, as is indicated, merely by way of example, in FIGS. 1 to 3. The end of the wire convergence is symbolically indicated there by the point E; the solids content of the paper web has reached there approximately

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the value of 8%. This point can, however, also lie, for instance, on one of the flat suction boxes 31. Behind this point, it is attempted further to increase the solids content, if possible even before the separation of the two wires. One goal is, namely, for the separation of the wires to take place with the highest possible solids content of the web so that as few fibers as possible are torn out of the web upon the separation. The nature and number of the drainage elements necessary for this within the twin-wire zone may, however, differ greatly and is dependent, among other things, on the type of paper and the raw-material components thereof, as well as on the operating speed.

The embodiments shown in FIGS. 2 and 3 differ from the others primarily by the fact that the twin-wire zone rises substantially vertically upward in the direction of travel of the wires. In this way, the removal of the water withdrawn from the fiber suspension is simplified since the water can be discharged relatively uniformly towards both sides. No vacuum chambers are required in particular in the central section II of the twin-wire zone. To be sure, the forming roll 40 of FIG. 2 is, as a rule, developed as a suction roll. The forming shoes 16, 23, particularly those arranged in the third section III, can, if necessary, be provided with a suction device.

Further elements of the twin-wire former shown in FIG. 2 are water-collection containers 41, 42 and 43, guide plates 44 associated with the fixed strips 28, and a water removal strip 45. The other elements are provided with the same reference numbers as the corresponding elements in FIG. 1. The same is true with regard to FIG. 3. One possible modification of FIG. 3 can consist therein that, instead of the wire suction roll 20, a forming roll is provided, and instead of the guide roll 19 the wire suction roll. A similar arrangement is known from German Utility Model 88 06 036 (Voith File: P 4539). Aside from this exception and aside from the embodiment according to FIG. 2 (with forming roll 40), the invention will, however, be used whenever possible-so to design the twin-wire former that the relatively expensive forming roll (as to purchase and operation) can be dispensed with. Thus, as a rule, the wire suction roll 20 is present as the sole suction roll. Furthermore, in all embodiments of the invention it can be seen to it that no guide roll which deflects the twin-wire zone (and has the above-mentioned injurious table-roll effect) is present.

The embodiment of FIG. 4 differs from FIG. 1 among other things by the fact that, in the first section I of the twin-wire zone, a second curved stationary forming shoe 16a is arranged in the loop of the lower wire 11 behind and spaced from a first curved stationary forming shoe 16. Furthermore, in the loop of the upper wire 12 in the region between the two stationary forming shoes 16 and 16a there is provided an individual strip 50 which in known manner is part of a vacuum chamber 51. This vacuum chamber 51, similar to the upper drainage box 18 of FIG. 1, is suspended on its front and rear ends in vertically displaceable mounts. In this way, both the depth of penetration of the strip 50 into the path of travel of the upper wire 12 as well as the angle of attack of the strip 50 can be varied. With slight depth of penetration, the strip 50 serves solely for removal of water, while with greater depth of penetration it serves, in addition, for the production of turbulence in the suspension and, thus, for improvement of the formation. By the presence of two separate forming shoes 16 and 16a, the pre-drainage on both sides is temporarily interrupted; it is only continued after the strip 50 has removed from the upper wire 12 the water which has penetrated upward on the first forming shoe 16. In this way, higher operating speeds are possible.

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Another difference from FIG. 1 is that, in the second section II of the twin-wire zone, the lower, flexibly supported strips 57 and the upper, firmly supported strips 58 are developed as individual strips. This means that each strip has its own supporting body 55/56. The lower strip-supporting bodies 55 are swingably mounted, the strip 57 being pressed resiliently by the force of springs 54 against the bottom of the lower wire 11. The supporting body 56 of each of the upper strips 58 is developed as vacuum chamber in the same way as that of the strip 50. The suspension of these vacuum chambers 56 corresponds to that of the vacuum chamber 51. It is important that each of the strips 57 and 58 rest with a given force of application (corresponding to the suspension pressure) against its wire belt 11 or 12. The strips 57 and 58 are adjusted in such a manner that a slight deflection of the wire belts takes place preferably on each strip. Due to the resilient supporting of the lower strips 57, the adjustment, once effected, is insensitive to changes in the quantity or quality of pulp, so that no backing up takes place in front of the strips and, nevertheless, an effective introduction of turbulence forces into the fiber suspension takes place. In contradistinction to FIGS. 1 to 3, there is the possibility of adjusting each one of the strips 57/58 individually with respect to position in height and inclination relative to the travel path of the wire. In this way, one can even better control the quality of the paper produced, with respect to both the formation and the nature of its surface (printability). Differing from FIG. 4, the upper strips 58 could be supported resiliently and the lower strips 57 stationary. Another alternative could consist therein that not only the upper strips 58 but also the lower strips 57 are fastened in vertically displaceable mounts (as shown on the vacuum chamber 51). In such case, the springs 54 might possibly be eliminated.

Another difference between FIGS. 1 and 4 resides in the fact that in FIG. 4 the twin-wire zone rises in the direction of travel of the wires upwards with an inclination of, on the average, about 20° with respect to the horizontal. In this way, it is possible to keep the entire height of the twin-wire former relatively slight. In the third section III of the twin-wire zone, a flat forming shoe 23' is provided rather than a curved one, differing from FIG. 1. The separation of the upper wire 12 from the lower wire and the fiber web formed can take place, as in FIG. 1, on one of the flat suction boxes 31. Instead of this, however, the upper wire 12 can also be conducted up to the wire suction roll 20. There, as shown, it can wrap around a small part (or, alternatively, a larger part) of the circumference of the wire suction roll and then be returned via the reversing roll 19.

In the embodiment shown in FIG. 5, the twin-wire zone, as a whole, extends substantially in horizontal direction. The individual elements are substantially the same as in the embodiment of FIG. 4. However, there is the difference that the drainage strips 57 and 58 lying in the second section II of the twin-wire zone are arranged along a downwardly curved path of the twin-wire zone. Accordingly, an upwardly curved forming shoe 16, 23 is provided in the first section I and in the third section III of the twin-wire zone. This embodiment is advisable, in particular, for the modernizing of existing Fourdrinier paper machines.

The embodiments shown have the feature in common that, in the second section II of the twin-wire zone, there are present preferably n flexibly supported strips 27/57 and n+1 rigidly supported strips. However, it is also possible to make the number of flexibly supported strips equal to or greater by one than the number of rigidly supported strips. Instead of a rigidly supported strip, a feed or discharge edge of a drainage box can also be provided. The minimum number n

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of flexibly supported strips is two (see FIG. 4). However, three or four flexibly supported strips are preferred.

What is claimed is:

1. A twin-wire former for the production of a paper web from a fiber suspension, the twin wire former comprising:

first and second web forming wire belts, means for directing the wire belts to travel along a path together for forming a twin wire zone of the twin wire former, with the web between the wire belts as the wire belts travel along the path through the twin wire zone, neither wire belt defining a single wire predrainage zone;

each wire belt forming an endless loop;

the twin wire zone having a first section which includes a first drainage element at the start of the path through the twin wire zone, means for supporting the belts for forming a wedge shaped entrance slot into the first section, a fiber suspension supplying headbox having an outlet placed and directed for delivering fiber suspension from the headbox to the wedge shaped entrance slot of the first section of the twin wire zone;

the twin wire zone having a second section following the first section along the path of the belts through the twin wire zone in the second section, a plurality of first drainage strips are positioned for contacting the first wire belt; in the second section, a plurality of second drainage strips are positioned within the loop of the second wire belt and are for contacting the second wire belt; the first strips being shifted in position along the path of the wire belts with respect to the second strips so that the first and second strips are offset and in a non-opposing relationship; first support means for resiliently supporting the first drainage strips against the respective wire belt that the strips contact;

second support means supporting the second drainage strips rigidly against the second wire belt;

first means for collecting the water drained from the fiber suspension by the most upstream, one of the drainage strips;

second means separate from the first means for collecting the water drained from the fiber suspension by all of the other drainage strips; and

the twin wire zone having a third section following the second section along the path of the wire belts through the twin wire zone; a second drainage element in the third section for being engaged by one of the wire belts as the wire belts travel over the second drainage element, the twin wire zone being free of rolls which deflect the twin wire zone.

2. A twin-wire former for the production of a paper web from a fiber suspension, the twin wire former comprising:

first and second web forming wire belts, means for directing the wire belts to travel along a path together for forming a twin wire zone of the twin wire former, with the web between the wire belts as the wire belts travel along the path through the twin wire zone, neither wire belt defining a single wire predrainage zone;

each wire belt forming an endless loop;

the twin wire zone having a first section which includes a first drainage element at the start of the path through the twin wire zone, means for supporting the belts for forming a wedge shaped entrance slot into the first section, a fiber suspension supplying headbox having an outlet placed and directed for delivering fiber sus-

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pension from the headbox to the wedge shaped entrance slot of the first section of the twin wire zone; the twin wire zone having a second section following the first section along the path of the belts through the twin wire zone; in the second section, a plurality of first drainage strips are positioned for contacting the first wire belt; in the second section, a plurality of second drainage strips are positioned within the loop of the second wire belt and are for contacting the second wire belt; the first strips being shifted in position along the path of the wire belts with respect to the second strips so that the first and second strips are offset and in a non-opposing relationship; first support means for resiliently supporting the first drainage strips against the respective wire belt that the strips contact; second support means supporting the second drainage strips rigidly against the second wire belt; first means for collecting the water drained from the fiber suspension by the most upstream one of the drainage strips; second means separate from the first means for collecting the water drained from the fiber suspension by all of the other drainage strips; and the twin wire zone having a third section following the second section along the path of the wire belts through the twin wire zone: a second drainage element in the third section for being engaged by one of the wire belts as the wire belts travel over the second drainage element, the twin wire zone being free of any forming rolls.

3. A twin-wire former for the production of a paper web from a fiber suspension, the twin wire former comprising: first and second web forming wire belts, means for directing the wire belts to travel along a path together for forming a twin wire zone of the twin wire former, with the web between the wire belts as the wire belts travel along the path through the twin wire zone, neither wire belt defining a single wire predrainage zone; each wire belt forming an endless loop; the twin wire zone having a first section which includes a first drainage element at the start of the path through the twin wire zone, means for supporting the belts for forming a wedge shaped entrance slot into the first section, a fiber suspension supplying headbox having an outlet placed and directed for delivering fiber suspension from the headbox to the wedge shaped entrance slot of the first section of the twin wire zone; the twin wire zone having a second section following the first section along the path of the belts through the twin wire zone; in the second section, a plurality of first drainage strips are positioned within the loop of the first wire belt and are for contacting the first wire belt; in the second section, a plurality of second drainage strips are positioned within the loop of the second wire belt and are for contacting the second wire belt; the first strips being shifted in position along the path of the wire belts with respect to the second strips so that the first and second strips are offset and in a non-opposing relationship; first support means for resiliently supporting the first drainage strips against the respective wire belt that the strips contact, the last one of the second drainage strips being located downstream of the last one of the first drainage strips; second support means supporting the second drainage strips rigidly against the second wire belt;

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the twin wire zone having a third section following the second section along the path of the wire belts through the twin wire zone; a second drainage element in the third section for being engaged by one of the wire belts as the wire belts travel over the second drainage element, the second drainage element having an open surface to enable water to be drained through the wire belt in contact therewith; and the twin wire zone being free of rolls which deflect the twin wire zone.

4. A twin-wire former for the production of a paper web from a fiber suspension, the twin wire former comprising: first and second web forming wire belts, means for directing the wire belts to travel along a path together for forming a twin wire zone of the twin wire former, with the web between the wire belts as the wire belts travel along the path through the twin wire zone, neither wire belt defining a single wire predrainage zone; each wire belt forming an endless loop; the twin wire zone having a first section which includes a first drainage element at the start of the path through the twin wire zone, means for supporting the belts for forming a wedge shaped entrance slot into the first section, a fiber suspension supplying headbox having an outlet placed and directed for delivering fiber suspension from the headbox to the wedge shaped entrance slot of the first section of the twin wire zone; the twin wire zone having a second section following the first section along the path of the belts through the twin wire zone; in the second section, a plurality of first drainage strips are positioned within the loop of the first wire belt and are for contacting the first wire belt; in the second section, a plurality of second drainage strips are positioned within the loop of the second wire belt and are for contacting the second wire belt; the first strips being shifted in position along the path of the wire belts with respect to the second strips so that the first and second strips are offset and in a non-opposing relationship; first support means for resiliently supporting the first drainage strips against the respective wire belt that the strips contact, the last one of the second drainage strips being located downstream of the last one of the first drainage strips; second support means supporting the second drainage strips rigidly against the second wire belt; the twin wire zone having a third section following the second section along the path of the wire belts through the twin wire zone; a second drainage element in the third section for being engaged by one of the wire belts as the wire belts travel over the second drainage element; and the twin wire zone being free of any forming rolls.

5. A twin-wire former for the production of a paper web from a fiber suspension, the twin wire former comprising: first and second web forming wire belts, means for directing the wire belts to travel along a path together for forming a twin wire zone of the twin wire former, with the web between the wire belts as the wire belts travel along the path through the twin wire zone, neither wire belt defining a single wire predrainage zone; each wire belt forming an endless loop; the twin wire zone having a first section which includes a single first drainage element at the start of the path

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through the twin wire zone, means for supporting the belts for forming a wedge shaped entrance slot into the first section, a fiber suspension supplying headbox having an outlet placed and directed for delivering fiber suspension from the headbox to the wedge shaped entrance slot of the first section of the twin wire zone; said single first drainage element in the first section being a single forming roll having an open surface to enable drainage of water from the fiber suspension and being curved along the path of the belts through the twin wire zone, the single forming roll being engaged by one of the wire belts for curving the path of the belts around the single forming roll after the entrance of the suspension into the entrance slot;

the twin wire zone having a second section following the first section along the path of the belts through the twin wire zone; in the second section, a plurality of first drainage strips are positioned within the loop of the first wire belt and are for contacting the first wire belt; in the second section, a plurality of second drainage strips are positioned within the loop of the second wire belt and are for contacting the second wire belt; the first strips being shifted in position along the path of the wire belts

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with respect to the second strips so that the first and second strips are offset and in a non-opposing relationship; first support means for resiliently supporting the first drainage strips against the respective wire belt that the strips contact;

second support means supporting the second drainage strips rigidly against the second wire belt; and

means for supplying a vacuum in the area of the second drainage strips;

the twin wire zone having a third section following the second section along the path of the wire belts through the twin wire zone; a second drainage element in the third section, for being engaged by one of the wire belts as the wire belts travel over the second drainage element, the second drainage element having an open surface to enable water to be drained through the wire belt in contact therewith; and

the twin wire zone apart from said single forming roll being free of rolls which deflect the twin wire zone.

* * * * *

EXHIBIT C



US005972168A

United States Patent [19]
Egelhof et al.

[11] **Patent Number:** **5,972,168**
 [45] **Date of Patent:** **Oct. 26, 1999**

- [54] **TWIN WIRE FORMER** 3,582,467 6/1971 Gustafson et al. 162/303
 3,726,758 4/1973 Parker et al. 162/273
 [75] Inventors: **Dieter Egelhof; Klaus Henseler**, both 3,772,145 11/1973 Notbohm 162/273
 of Heidenheim, Germany; **Werner** 3,994,774 11/1976 Halme et al. 162/301
Kade, Neenah, Wis.; **Albrecht** 4,609,435 9/1986 Tissari 162/301
Meinecke, Heidenheim, Germany; 4,769,111 9/1988 Nevalainen et al. 162/351
Wilhelm Wanke, Heidenheim, 4,917,766 4/1990 Koivuranta et al. 162/301
 Germany; **Hans-Jurgen Wulz**, 4,925,531 5/1990 Koski 162/301
 Heidenheim, Germany; **Rudolf Bück**, 4,999,087 3/1991 Ebihara et al. 162/301
 deceased, late of Heidenheim, Germany, 5,389,206 2/1995 Buck et al. 162/301
 by Elsie Bück, legal representative

[73] Assignee: **Voith Sulzer Papiertechnik Patent GmbH**, Germany

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[21] Appl. No.: **09/161,138**

[22] Filed: **Sep. 25, 1998**

Related U.S. Application Data

- [62] Continuation of application No. 09/023,435, Feb. 13, 1998, which is a continuation of application No. 08/556,769, Nov. 2, 1995, Pat. No. 5,718,805, which is a continuation of application No. 08/286,948, Aug. 8, 1994, Pat. No. 5,500,091, which is a continuation of application No. 08/055,918, Apr. 29, 1993, Pat. No. 5,389,206, which is a continuation of application No. 07/773,965, abandoned, filed as application No. PCT/EP90/01313, Sep. 8, 1990.

- [51] **Int. Cl.**⁶ **D21F 1/00**
 [52] **U.S. Cl.** **162/203; 162/301**
 [58] **Field of Search** 162/203, 300,
 162/301, 303, 348, 352

[56] **References Cited**

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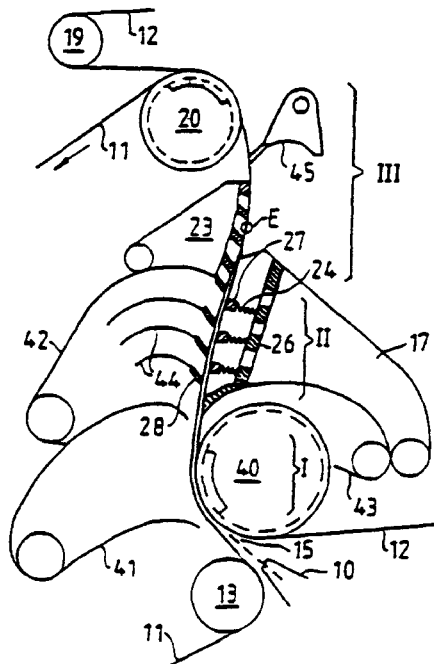
Primary Examiner—Karen M. Hastings

Attorney, Agent, or Firm—Ostrolenk, Faber, Gerb & Soffen, LLP

[57] **ABSTRACT**

In a twin-wire former for the production of a paper web, two wire belts (11 and 12) together form a twin-wire zone which is divided into three sections (I, II and III). In the first section (I) the two wires (11, 12) travel over a curved forming shoe (16). They form there a wedge-shaped inlet slot (15) with which a headbox (10) is directly associated. In the second section (II), several resiliently supported strips (27) rest against the lower wire (11) and between each of said strips (27) a rigidly mounted strip (28) rests against the upper wire (12). In the third section (III) both wire belts (11, 12) pass over another curved forming shoe (23).

8 Claims, 2 Drawing Sheets



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Fig.1

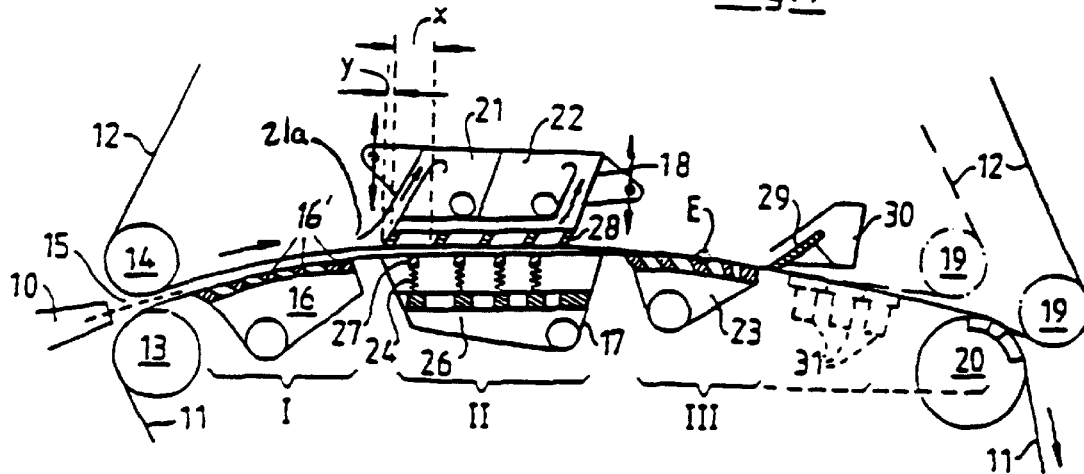


Fig.2

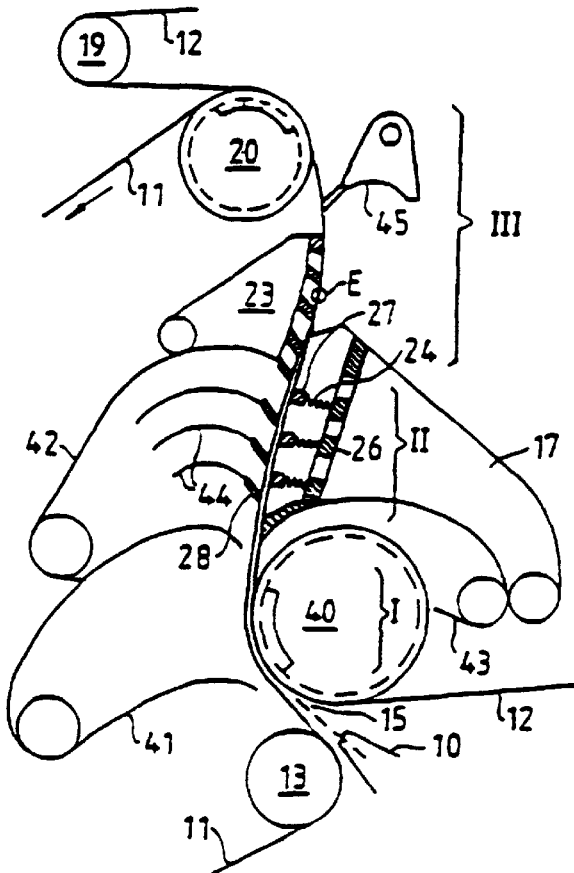
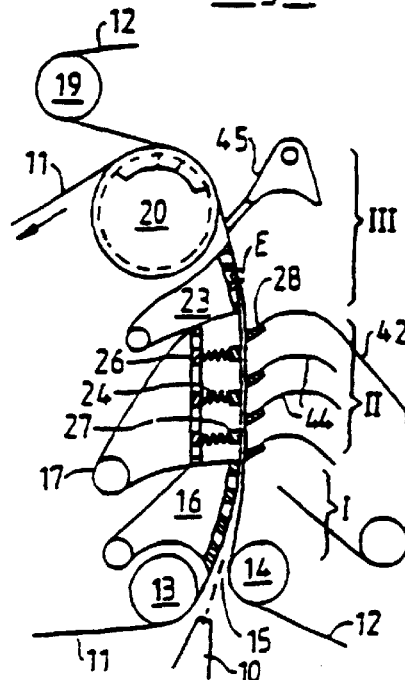


Fig.3



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Fig.4

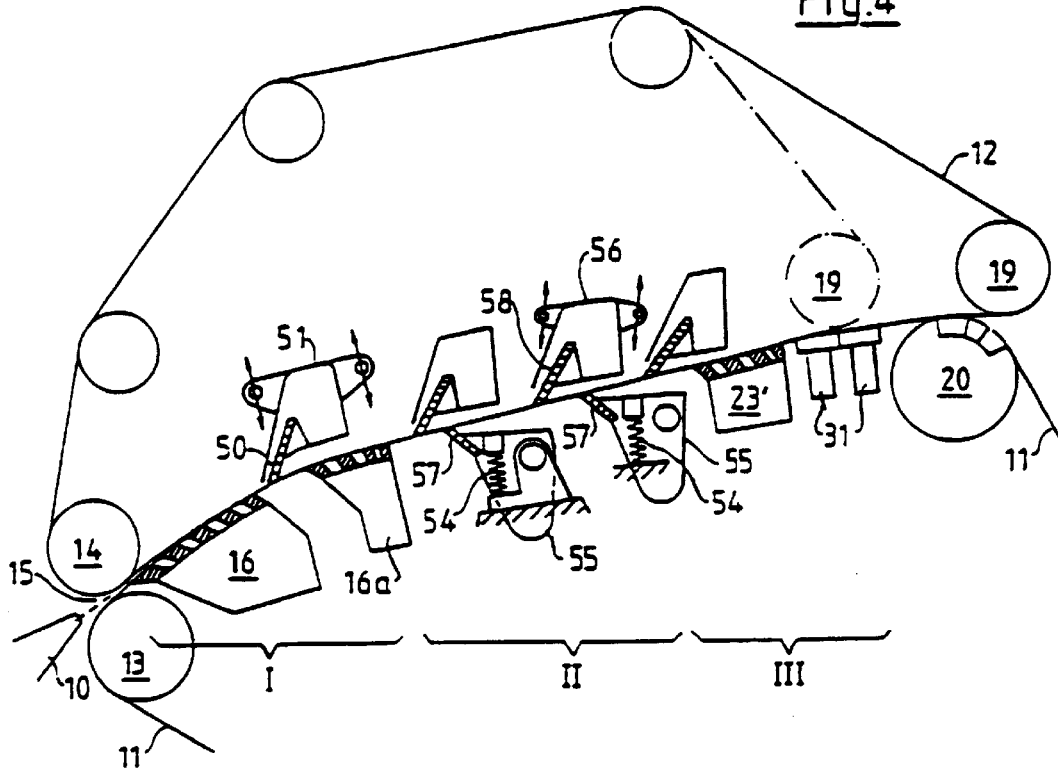
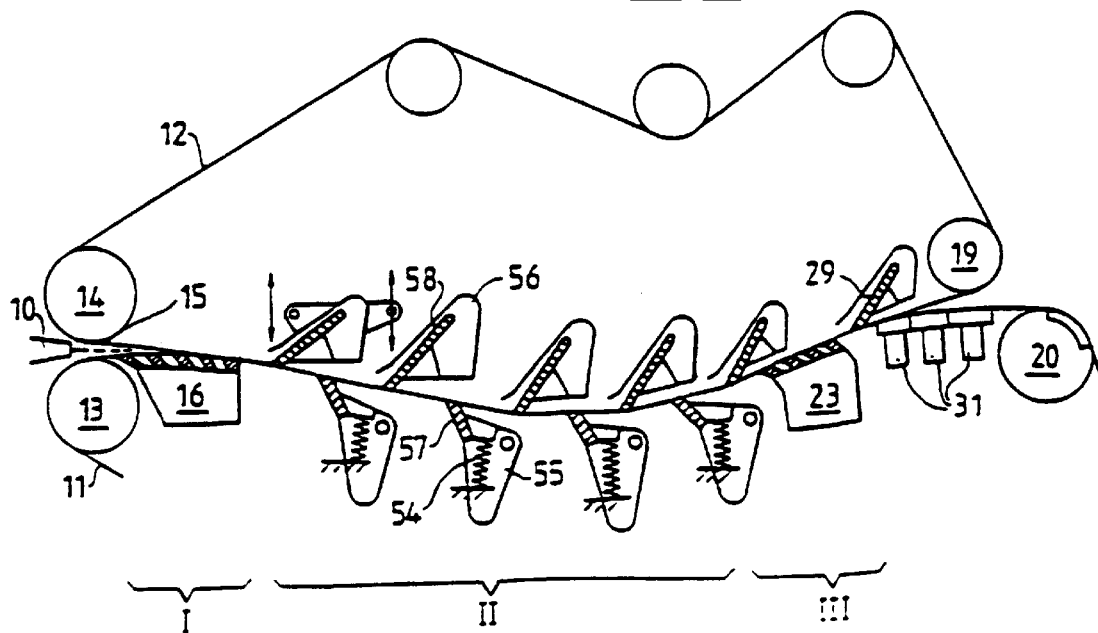


Fig.5



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TWIN WIRE FORMER**RELATED APPLICATIONS**

This is a continuing application of, and hereby incorporates by reference the entire disclosure of, application Ser. No. 09/023,435, filed Feb. 13, 1998, allowed, which is a continuing application of Ser. No. 08/556,769, filed Nov. 2, 1995, now Pat. No. 5,718,805, which is a continuing application of Ser. No. 08/286,948, filed Aug. 8, 1994, now Pat. No. 5,500,091, which is a continuing application of Ser. No. 08/055,918, filed Apr. 29, 1993, now Pat. No. 5,389,206, which is a continuing application of Ser. No. 07/773,965, filed Nov. 12, 1991, now abandoned, filed as PCT/EP90/01313 on Sept. 8, 1990, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to a twin-wire former for the production of a fiber web, in particular a paper web, from a fiber suspension. The invention proceeds from the basis of the twin-wire former known from British Patent 1 125 906. The features indicated in the patent include a twin wire former for producing a fiber web and particularly a paper web from a fiber suspension. Two web forming wire belts, in the form of endless loops, travel together to form a twin wire zone. The web travels between and along the path of the wire belts through the twin wire zone. The twin wire zone has three sections and the elements in those three sections are described below. The patent describes features that state, in other words, that the forming of the fiber web from the pulp suspension fed from the headbox takes place exclusively between two wire belts. Thus, there is no so-called single-wire pre-drainage path. In a first section of the twin-wire zone, the two wire belts together form a wedge-shaped inlet slot; a jet of pulp slurry coming from the headbox discharges into it. The jet strikes the two wire belts at a place where they pass over a curved drainage element; in the case of the aforementioned British patent, this is a stationary, curved forming shoe. Its curved wire guide surface is formed of a plurality of strips with drainage slots between them. This forming shoe is followed (in a second section of the twin-wire zone) by a drainage strip arranged in the other wire loop and, behind the latter, by a drainage strip arranged in the first-mentioned wire loop (and formed by a first suction box). Finally, in a third section of the twin-wire zone there are a plurality of stationary drainage elements developed as flat suction boxes.

It has been attempted for decades with twin-wire formers of the known type to produce fiber webs (in particular, paper webs) of the highest possible quality with relatively high operating speeds. Due to the forming of the web between two wires, the result, in particular, is obtained that the final fiber web has substantially the same properties on both sides (little "two-sidedness"). However, it is difficult to obtain as uniform as possible a distribution of the fibers in the final fiber web. In other words, it is difficult to obtain a good "formation" since while the web is formed, there is always the danger that fibers will agglomerate and form flocculations. Therefore, it is attempted to form a jet of pulp slurry which pulp slurry is as free as possible of flocculations in the headbox (for instance, by means of a turbulence producer). It is, furthermore, endeavored so to influence the drainage of the fiber suspension during the web-forming that "reflocculation" is avoided as far as possible or that, after possible flocculation, a "deflocculation" (i.e. a breaking up of the flocculations) takes place.

It is known that a curved drainage element arranged in the first section of the twin-wire zone and, in particular, a

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stationary curved forming shoe developed in accordance with the aforementioned British Patent 1 125 906 counteracts the danger of reflocculation. This is true also of the drainage strips arranged in the British Patent in the second section of the twin-wire zone. Nevertheless, the danger of reflocculation is not completely eliminated in the arrangement according to said British Patent. Since the number of drainage strips there is very small, a large part of the web-forming takes place in the region of the following flat-suction boxes. They, to be sure, are of high drainage capacity so that the web-forming can be completed in the region of the last flat suction boxes (i.e. the so-called main drainage zone, in which a part of the fiber material is still in the form of a suspension, terminates in the region of the flat suction box). The flat suction boxes, however, are not able to avoid reflocculation or to break up flocculations which have already occurred.

In order to control these last-mentioned difficulties, a web-forming device known under the name of "Duoformer D" has been developed (TAPPI Proceedings 1988 annual meeting, pages 75 to 80). This known web-forming device is part of a twin-wire former which has a single-wire pre-drainage zone. In the twin-wire zone there are provided, in the one wire loop, a plurality of strips which are fixed in position but adjustably supported, namely, on the bottom of a suction box which drains in upward direction. Furthermore, a plurality of resiliently supported strips are provided in the other wire loop. By this resilience of the last-mentioned strips, the following result can be obtained: For example, upon an increase of the amount of suspension entering between the two wire belts, the flexibly supported strips can move away somewhat. In this way, the danger (which is present when only firmly supported strips are used) is eliminated of a backing up taking place in the fiber suspension in front of the strips. Such a backing up could destroy the fiber layers which have been formed up to then on the two wire belts. In other words, with this known web-forming device, a drainage pressure, once established, remains constant due to the resiliently supported strips even upon a change in the amount of suspension fed or upon a change in the drainage behavior of the fiber suspension. Therefore, automatic adaptation of the web-forming device to said changed conditions occurs.

With this known web-forming device, fiber webs of relatively good formation can also be formed. With respect to this, however, the demands have increased considerably recently, so that further improvements are desirable.

SUMMARY OF THE INVENTION

The object of the invention is so to develop a twin-wire of the aforementioned kind that the quality of the fiber web produced is further improved, particularly with respect to its formation (cloudiness), and that the twin-wire former can easily be adapted to different operating conditions (for instance, with regard to quantity and drainage behavior of the fiber suspension).

This object is achieved by the features set forth below in particular, there is a respective drainage strip above each of the two wire belts in the second section of the twin wire zone, and at least one of the two drainage strips is supported resiliently against the respective wire belt while the other may or may not be resiliently supported, and typically is rigidly supported against the respective wire belt. Preferably, there are at least two of the drainage strips and often more against each of the wire belts. The drainage strips against one belt are offset along the path of the wire belts with

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respect to the drainage strips against the other belt, providing a zig zag or staggered array, and the drainage strips against at least one of the belts are resiliently supported.

The inventors have found that a combination of known features, namely:

- A. Twin-wire former without a single-wire pre-drainage zone or at least without a single-wire pre-drainage zone of any substantial length such as to cause any appreciable pre-drainage
- B. Start of the drainage in the twin-wire zone at a preferably curved drainage element, for instance on a rotating forming cylinder or, even better, on a curved stationary forming shoe
- C. Further drainage in the twin-wire zone between strips which are arranged along a "zig-zag" line, the strips which rest against the one wire belt being resiliently supported, leads to an extremely high increase in the quality of the finished fiber web, so that it satisfies even the highest requirements. At the same time, the twin-wire former of the invention is insensitive to changes in the amount of suspension fed and to changes in the drainage behavior of the fiber suspension. Experiments have shown that it is possible by the invention to obtain both a high increase in quality with respect to the formation and also good values with regard to the retention of fillers and fines. In contradistinction to this, in the known double-wire formers it is constantly found that there is a strong reduction in the retention upon an improvement in the formation.

It was, furthermore, found in experiments that in the second section of the twin-wire zone the number of strips can be considerably reduced as compared with the "Duo-former D". However, this number is substantially greater than in the case of the twin-wire former known from British Patent 1 125 906. It is advantageous to increase the distance between adjacent strips as compared with the "Duo-former D". In particular, the drainage strips above each one of the wire belts are of a thickness along the path of the wire belts and the spacing between adjacent strips above each wire belt is a minimum of about three times the strip thickness.

To be sure, from German OS 31 38 133, FIG. 3, a twin-wire former is known the twin-wire zone of which is provided in a first section with a curved stationary drainage element and in a second section with strips arranged along a "zig-zag" line, which strips may also be resiliently supported and there being a relatively large distance between them. However, in that case, in front of the twin-wire zone there is a single-wire pre-drainage zone in which the forming of the web starts initially only in a lower layer of the fiber suspension fed while the upper layer remains liquid and tends very strongly to flocculation. It has been found that these flakes cannot be broken up again to the desired extent in the following twin-wire zone. Another disadvantage is that the twin-wire zone is diverted by a guide roll (14b) behind the second section. This results (due to the so-called table-roll effect) in a further drainage which is uneven over the width of the web and thus in undesired variations in the quality of the web (recognizable, for instance, by disturbing longitudinal stripes).

BRIEF DESCRIPTION OF THE DRAWINGS

Other developments of the invention will be explained below with reference to embodiments which are shown in the drawing. Each of FIGS. 1 to 5 shows in simplified diagrammatic form one of the different embodiments.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The twin-wire former shown in FIG. 1 has a substantially horizontally extending twin-wire zone; this zone comprises

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three sections I, II and III arranged one behind the other. The endless wire belts (lower wire 11 and upper wire 12), shown only in part, travel in the direct vicinity of a headbox 10 over, in each case, a breast roll 13 and 14 respectively, so that the two wire belts together form a wedge-shaped entry slot 15 at the start of the twin-wire zone. The jet pulp discharged by the headbox 10 comes into contact with the two wire belts 11 and 12 only at the place where the lower wire 11 in the first section I of the twin-wire zone travels over a stationary curved forming shoe 16. The curved travel surface thereof is formed of several strips 16' with drainage slits present between them. The distance between the two breast rolls 13 and 14 is variable. The forming shoe 16 can be operated with or without vacuum. Additionally, although it is preferable that the forming shoe 16 be curved, a straight forming shoe may also be used in certain situations.

In the second section II of the twin-wire zone, the two wire belts 11 and 12 (with the partially still liquid fiber suspension present between them) travel between a lower drainage box 17 and an upper drainage box 18. In the lower drainage box 17 there are a row of at least two strips 27 (preferably of approximately rectangular cross section) which are pressed from below resiliently against the lower wire 11. For this purpose, they are supported, for instance, on springs 24 (or pneumatic pressure cushions) on a, preferably water-permeable, plate. It is obvious that the force of the springs (or of the pressure prevailing in the pressure cushions) is individually adjustable.

The upper drainage box 18 is suspended on both the front and rear ends on vertically displaceable support elements as indicated diagrammatically by double arrows. On its lower side, there is a row of at least three strips 28 of preferably parallelogram cross section which rest against the upper side of the upper wire 12 and are rigidly attached to the box 18. Above the strips 28, a front vacuum chamber 21 and a rear vacuum chamber 22 are present in the drainage box 18.

Each of the upper strips 28 scrapes off water from the wire 12. Accordingly, the amount of water scraped off decreases in the direction of flow of the wire 12 from strip to strip. The drainage water from each of the strips 28 except the drainage water scraped off by the first strip may be drained away jointly. However, it is disadvantageous to also include the drainage water from the first strip 28 since this generally would disturb the operation of the other strips. Accordingly, a vertical channel 21a is positioned in front of the first upper strip 28 to carry away or collect the water scraped off by the first strip 28.

In the region of the forming shoe 16, a part of the water of the fiber suspension is led off downward; another part penetrates due to the tension of the upper wire 12 upwards through the upper wire and is deflected by the furthest in front of the strips 28 into the front vacuum chamber 21. The water passing upward between the upper strips 28 enters into the rear vacuum chamber 22. The water penetrating between the lower strips 27 through the lower wire 11 is led off downward. Between adjacent upper drainage strips 28 there is a minimum distance X of about three times the thickness Y of the strips. The same is true of the lower resiliently supported strips 27. It is important that each of the strips 27 and 28 lies in the region of a space between two opposite strips so that a "zig-zag" arrangement (i.e. non-opposing relationship) is present. Also, as seen in FIG. 1, the first one of the strips 28 is located upstream of the first one of the strips 27. The two wires 11 and 12 preferably travel on a straight path through section II. Gentle curvature of this section of the path is, however, also possible; see FIGS. 2 and 5. Differing from FIG. 1, the resiliently supported strips

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could also be arranged in the upper box **18** and the firmly supported strips in the lower box **17**. In the third section III of the twin-wire zone, both wire belts **11** and **12** travel over another preferably curved forming shoe **23** which (as shown) is arranged preferably in the lower wire loop **11**. Behind it, an additional strip **29** with vacuum chamber **30** can be arranged in the loop of the upper wire **12**. Furthermore, flat suction boxes **31** can be present in the loop of the lower wire. There (as is shown by dash-dot lines) the upper wire **12** can be separated by means of a guide roll **19** from the lower wire **11** and from the fiber web formed. Lower wire and fiber web then travel over a wire suction roll **20**. The guide roll **19** can, however, also lie further back, so that the upper wire **12** is separated from the lower wire **11** only on the wire suction roll **20**.

It is important that two drainage boxes **17** and **18** with the alternately resiliently and firmly supported ledge strips **27** and **28** lie not in the front or the rear sections but in the middle section II of the twin-wire zone, since only here can they develop their full effect, namely, intensive drainage of the fiber suspension fed while retaining the fine flocculation-free fiber distribution. This is achieved in the manner that the corresponding wire belt is imparted a slight (scarcely visible) deflection on each strip so that turbulence is constantly produced in the still liquid part of the fiber pulp. For success it is, however, also decisive that previously, in section I, a known pre-drainage towards both sides has already taken place and that this also takes place with the greatest possible retention of the flocculation-free condition of the fiber suspension.

For this two-sided pre-drainage, a stationary preferably curved forming shoe is provided in the first section I of the twin-wire zone (in accordance with FIGS. 1 and 3-5) whenever it is a question of satisfying the highest quality demands with respect to the formation. This effect of the forming shoe is due to the fact that at least the one wire belt travels polygonally from strip to strip, each strip not only leading water away but also producing turbulence in the pulp which is still liquid. With such a forming shoe, it is, however, difficult at times to obtain a stable operating condition upon the starting of the paper machine. Therefore, it may be advantageous to provide a known forming roll **40** in accordance with FIG. 2 in Section I instead of the stationary forming shoe and the breast roll lying in front of it. This possibility will be utilized when, in particular, the highest productivity is demanded from the paper manufacturing machine.

In the third section III, the aforementioned strip **29** can serve either solely to lead away water upwards or, in addition, for the further production of turbulence (for further improvement in quality). The latter is possible if a part of the fiber pulp is still in liquid condition at this place.

In FIGS. 1 to 3, the distance between the two wires **11** and **12** in the twin-wire zone has been shown greatly exaggerated. By this, it is intended to make it clear that the two wires **11** and **12** converge towards each other over a relatively long path within the twin-wire zone. This makes it clear that the process of web-forming on the first forming shoe **16** (in Section I) commences relatively slowly and is completed only in Section III. In this connection, the end of the main drainage zone in which the two wires converge towards each other (and thus, the end of the web-forming process) can lie approximately in the center of the wrapping zone of the second forming shoe **23**, as is indicated, merely by way of example, in FIGS. 1 to 3. The end of the wire convergence is symbolically indicated there by the point E; the solids content of the paper web has reached there approximately

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the value of 8%. This point can, however, also lie, for instance, on one of the flat suction boxes **31**. Behind this point, it is attempted further to increase the solids content, if possible even before the separation of the two wires. One goal is, namely, for the separation of the wires to take place with the highest possible solids content of the web so that as few fibers as possible are torn out of the web upon the separation. The nature and number of the drainage elements necessary for this within the twin-wire zone may, however, differ greatly and is dependent, among other things, on the type of paper and the raw-material components thereof, as well as on the operating speed.

The embodiments shown in FIGS. 2 and 3 differ from the others primarily by the fact that the twin-wire zone rises substantially vertically upward in the direction of travel of the wires. In this way, the removal of the water withdrawn from the fiber suspension is simplified since the water can be discharged relatively uniformly towards both sides. No vacuum chambers are required in particular in the central section II of the twin-wire zone. To be sure, the forming roll **40** of FIG. 2 is, as a rule, developed as a suction roll. The forming shoes **16**, **23**, particularly those arranged in the third section III, can, if necessary, be provided with a suction device.

Further elements of the twin-wire former shown in FIG. 2 are water-collection containers **41**, **42** and **43**, guide plates **44** associated with the fixed strips **28**, and a water removal strip **45**. The other elements are provided with the same reference numbers as the corresponding elements in FIG. 1. The same is true with regard to FIG. 3. One possible modification of FIG. 3 can consist therein that, instead of the wire suction roll **20**, a forming roll is provided, and instead of the guide roll **19** the wire suction roll. A similar arrangement is known from German Utility Model 88 06 036 (Voith File: P 4539). Aside from this exception and aside from the embodiment according to FIG. 2 (with forming roll **40**), the invention will, however, be used whenever possible-so to design the twin-wire former that the relatively expensive forming roll (as to purchase and operation) can be dispensed with. Thus, as a rule, the wire suction roll **20** is present as the sole suction roll. Furthermore, in all embodiments of the invention it can be seen to it that no guide roll which deflects the twin-wire zone (and has the above-mentioned injurious table-roll effect) is present.

The embodiment of FIG. 4 differs from FIG. 1 among other things by the fact that, in the first section I of the twin-wire zone, a second curved stationary forming shoe **16a** is arranged in the loop of the lower wire **11** behind and spaced from a first curved stationary forming shoe **16**. Furthermore, in the loop of the upper wire **12** in the region between the two stationary forming shoes **16** and **16a** there is provided an individual strip **50** which in known manner is part of a vacuum chamber **51**. This vacuum chamber **51**, similar to the upper drainage box **18** of FIG. 1, is suspended on its front and rear ends in vertically displaceable mounts. In this way, both the depth of penetration of the strip **50** into the path of travel of the upper wire **12** as well as the angle of attack of the strip **50** can be varied. With slight depth of penetration, the strip **50** serves solely for removal of water, while with greater depth of penetration it serves, in addition, for the production of turbulence in the suspension and, thus, for improvement of the formation. By the presence of two separate forming shoes **16** and **16a**, the pre-drainage on both sides is temporarily interrupted; it is only continued after the strip **50** has removed from the upper wire **12** the water which has penetrated upward on the first forming shoe **16**. In this way, higher operating speeds are possible.

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Another difference from FIG. 1 is that, in the second section II of the twin-wire zone, the lower, flexibly supported strips 57 and the upper, firmly supported strips 58 are developed as individual strips. This means that each strip has its own supporting body 55/56. The lower strip-supporting bodies 55 are swingably mounted, the strip 57 being pressed resiliently by the force of springs 54 against support bottom of the lower wire 11. The supporting body 56 of each of the upper strips 58 is developed as vacuum chamber in the same way as that of the strip 50. The suspension of these vacuum chambers 56 corresponds to that of the vacuum chamber 51. It is important that each of the strips 57 and 58 rest with a given force of application (corresponding to the suspension pressure) against its wire belt 11 or 12. The strips 57 and 58 are adjusted in such a manner that a slight deflection of the wire belts takes place preferably on each strip. Due to the resilient supporting of the lower strips 57, the adjustment, once effected, is insensitive to changes in the quantity or quality of pulp, so that no backing up takes place in front of the strips and, nevertheless, an effective introduction of turbulence forces into the fiber suspension takes place. In contradistinction to FIGS. 1 to 3, there is the possibility of adjusting each one of the strips 57/58 individually with respect to position in height and inclination relative to the travel path of the wire. In this way, one can even better control the quality of the paper produced, with respect to both the formation and the nature of its surface (printability). Differing from FIG. 4, the upper strips 58 could be supported resiliently and the lower strips 57 stationary. Another alternative could consist therein that not only the upper strips 58 but also the lower strips 57 are fastened in vertically displaceable mounts (as shown on the vacuum chamber 51). In such case, the springs 54 might possibly be eliminated.

Another difference between FIGS. 1 and 4 resides in the fact that in FIG. 4 the twin-wire zone rises in the direction of travel of the wires upwards with an inclination of, on the average, about 20° with respect to the horizontal. In this way, it is possible to keep the entire height of the twin-wire former relatively slight. In the third section III of the twin-wire zone, a flat forming shoe 23' is provided rather than a curved one, differing from FIG. 1. The separation of the upper wire 12 from the lower wire and the fiber web formed can take place, as in FIG. 1, on one of the flat suction boxes 31. Instead of this, however, the upper wire 12 can also be conducted up to the wire suction roll 20. There, as shown, it can wrap around a small part (or, alternatively, a larger part) of the circumference of the wire suction roll and then be returned via the reversing roll 19.

In the embodiment shown in FIG. 5, the twin-wire zone, as a whole, extends substantially in horizontal direction. The individual elements are substantially the same as in the embodiment of FIG. 4. However, there is the difference that the drainage strips 57 and 58 lying in the second section II of the twin-wire zone are arranged along a downwardly curved path of the twin-wire zone. Accordingly, an upwardly curved forming shoe 16, 23 is provided in the first section I and in the third section III of the twin-wire zone. This embodiment is advisable, in particular, for the modernizing of existing Fourdrinier paper machines.

The embodiments shown have the feature in common that, in the second section II of the twin-wire zone, there are present preferably n flexibly supported strips 27/57 and n+1 rigidly supported strips. However, it is also possible to make the number of flexibly supported strips equal to or greater by one than the number of rigidly supported strips. Instead of a rigidly supported strip, a feed or discharge edge of a drainage box can also be provided. The minimum number n

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of flexibly supported strips is two (see FIG. 4). However, three or four flexibly supported strips are preferred.

What is claimed is:

1. A method for the production of a paper web from a fiber suspension in a twin wire former comprising:

causing first and second web forming wire belts to travel along a path together to form a twin wire zone of the twin wire former, with the web between the wire belts as the wire belts travel along the path through the twin wire zone, each wire belt forming an endless loop;

feeding the wire belts across a single forming roll at the start of the path through the twin wire zone;

supporting the wire belts such as to form a wedge shaped entrance slot into the twin wire zone;

supplying a fiber suspension from a headbox directly to the wedge shaped entrance slot of the twin wire zone;

draining water from the fiber suspension by means of the forming roll in order to start the forming of the web from the fiber suspension;

feeding the wire belts with the fiber suspension and the web being generated therebetween downstream of the forming roll between a plurality of first drainage strips, which are positioned within the loop of the first wire belt for contacting the first wire belt, and a plurality of second drainage strips, which are positioned within the loop of the second wire belt for contacting the second wire belt, the first strips being shifted in position along the path of the wire belts with respect to the second strips so that the first and second strips are offset and in a non-opposing relationship;

resiliently supporting the first drainage strips against the first wire belt that the strips contact;

rigidly supporting the second drainage strips against the second wire belt;

feeding the wire belts with the web therebetween downstream of said drainage strips across a stationary drainage element and then across a suction roll in the twin wire zone such that as the wire belts travel over the stationary drainage element and over said suction roll, water is drained through the wire belt in contact with said stationary drainage element and with said suction roll; and

maintaining the twin wire zone apart from said single forming roll and said suction roll free of rolls which would deflect the twin wire zone.

2. The method of claim 1, further comprising supplying a vacuum in the area of the second drainage strips.

3. A twin-wire former for the production of a paper web from a fiber suspension, the twin wire former comprising:

first and second web forming wire belts which travel along a path together for forming a twin wire zone of the twin wire former, with the web between the wire belts as the wire belts travel along the path through the twin wire zone, neither wire belt defining a single wire predrainage zone;

each wire belt forming an endless loop;

the twin wire zone having a first section which includes a single forming roll at the start of the path of the wire belts through the twin wire zone; supports which support the wire belts for forming a wedge shaped entrance slot into the first section;

a fiber suspension supplying headbox having an outlet placed and directed for delivering fiber suspension from the headbox to the wedge shaped entrance slot of the first section of the twin wire zone;

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said single forming roll having an open surface to enable drainage of water from the fiber suspension and being curved along the path of the wire belts through the twin wire zone, the single forming roll being engaged by one of the wire belts and being arranged for curving the path of both wire belts around the single forming roll after the entrance of the suspension into the entrance slot;

the twin wire zone having a second section following the first section along the path of the wire belts through the twin wire zone; in the second section, a plurality of the first drainage strips are positioned within the loop of the first wire belt and are for contacting the first wire belt; in the second section, a plurality of second drainage strips are positioned within the loop of the second wire belt and are for contacting the second wire belt; the first strips being shifted in position along the path of the wire belts with respect to the second strips so that the first and second strips are offset and in a non-opposing relationship; a first strip support which resiliently supports the first drainage strips against the first wire belt that the first strips contact;

a second strip support which supports the second drainage strips rigidly against the second wire belt;

the twin wire zone having a third section following the second section along the path of the wire belts through the twin wire zone; drainage elements in the third section, for being engaged by one of the wire belts as the wire belts travel over the drainage elements, the drainage elements including at least one stationary dewatering element followed by a suction roll and having an open surface to enable water to be drained through the wire belt in contact therewith; and

the twin wire zone apart from said single forming roll and said suction roll being free of rolls which deflect the twin wire zone.

4. The twin-wire former of claim 3, further comprising a supplier of vacuum in the area of the second drainage strips.

5. A method for the production of a paper web from a fiber suspension in a twin wire former comprising:

causing first and second web forming wire belts to travel along a path together to form a twin wire zone of the twin wire former, with the web between the wire belts as the wire belts travel along the path through the twin wire zone, each wire belt forming an endless loop;

feeding the wire belts across a stationary curved forming shoe at the start of the path through the twin wire zone;

supporting the wire belts such as to form a wedge shaped entrance slot into the twin wire zone;

supplying a fiber suspension from the head box directly to the wedge shaped entrance slot of the twin wire zone;

draining water from the fiber suspension by means of the forming shoe in order to start the forming of the web from the fiber suspension;

feeding the wire belts with the fiber suspension and the web being generated therebetween downstream of the forming shoe between a plurality of first drainage strips, which are positioned within the loop of the first wire belt for contacting the first wire belt, and a plurality of second drainage strips, which are positioned within the loop of the second wire belt for contacting the second wire belt, the first strips being shifted in position along the path of the wire belts with respect to the second strips so that the first and second strips are offset and in a non-opposing relationship;

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resiliently supporting the first drainage strips against the first wire belt that the strips contact;

rigidly supporting the second drainage strips against the second wire belt;

feeding the wire belts with the web therebetween downstream of said drainage strips across a stationary drainage element and then across a suction roll in the twin wire zone such that as the wire belts travel over the stationary drainage element and the suction roll, water is drained through the wire belt in contact with said stationary drainage element and the suction roll; and

maintaining the twin wire zone apart from said suction roll free of rolls which would deflect the twin wire zone.

6. The method of claim 5, further comprising supplying a vacuum in the area of the second drainage strips.

7. A twin-wire former for the production of a paper web from a fiber suspension, the twin wire former comprising:

first and second web forming wire belts which travel along a path together for forming a twin wire zone of the twin wire former, with the web between the wire belts as the wire belts travel along the path through the twin wire zone, neither wire belt defining a single wire predrainage zone;

each wire belt forming an endless loop;

the twin wire zone having a first section which includes a stationary curved forming shoe at the start of the path of the wire belts through the twin wire zone; supports which support the wire belts for forming a wedge shaped entrance slot into the first section;

a fiber suspension supplying headbox having an outlet placed and directed for delivering fiber suspension from the headbox to the wedge shaped entrance slot of the first section of the twin wire zone;

said stationary curved forming shoe having an open surface to enable drainage of water from the fiber suspension and being curved along the path of the wire belts through the twin wire zone, the forming shoe being engaged by one of the wire belts and being arranged for curving the path of both wire belts around the forming shoe after the entrance of the suspension into the entrance slot;

the twin wire zone having a second section following the first section along the path of the wire belts through the twin wire zone; in the second section, a plurality of the first drainage strips are positioned within the loop of the first wire belt and are for contacting the first wire belts; in the second section, a plurality of second drainage strips are positioned within the loop of the second wire belt and are for contacting the second wire belt; the first strips being shifted in position along the path of the wire belts with respect to the second strips so that the first and second strips are offset and in a non-opposing relationship; a first strip support which resiliently supports the first drainage strips against the first wire belt that the first strips contact;

a second strip support which supports the second drainage strips rigidly against the second wire belt;

the twin wire zone having a third section following the second section along the path of the wire belts through the twin wire zone; a stationary drainage element followed by a suction roll in the third section, for being engaged by one of the wire belts as the wire belts travel over the stationary drainage element and said suction roll, the stationary drainage element and said suction

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roll having an open surface to enable water to be drained through the wire belt in contact therewith; and the twin wire zone apart from said suction roll being free of rolls which deflect the twin wire zone.

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8. The twin-wire former of claim 7, further comprising a supplier of vacuum in the area of the second drainage strips.

* * * * *

**UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION**

PATENT NO. : 5,972,168
DATED : October 26, 1999
INVENTOR(S) : Egelhof, et. al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Please correct the first name of the 7th inventor's legal representative as follows:
[75] Else Bück, legal representative

Please add the following missing priority data:
[30] **Foreign Application Priority Data**
August 22, 1989 [DE] Germany....P 39 27 597.3

Please correct the Related U.S. Application Data as follows:

[62] Continuation of application No. 09/023,435, Feb. 13, 1998, which is a continuation of application No. 08/556,769, Nov. 2, 1995, Pat. No. 5,718,805, which is a continuation of application No. 08/286,948, Aug. 8, 1994, Pat. No. 5,500,091, which is a continuation of application No. 08/055,918, April 29, 1993, Pat. No. 5,389,206, which is a continuation of application No. 07/773,965, Nov. 12, 1998, abandoned, filed as application No. PCT/EP90/01313, Aug. 9, 1990.

**Signed and Sealed this
Thirtieth Day of May, 2000**

Attest:



Q. TODD DICKINSON

Attesting Officer

Director of Patents and Trademarks

EXHIBIT D



US005389206A

United States Patent [19]

Bück et al.

[11] **Patent Number:** **5,389,206**[45] **Date of Patent:** **Feb. 14, 1995**[54] **TWIN WIRE FORMER**

[75] Inventors: **Rudolf Bück; Dieter Egelhof; Klaus Henseler**, all of Heidenheim, Germany; **Werner Kade**, Neenah, Wis.; **Albrecht Meinecke**, Heidenheim, Germany; **Wilhelm Wanke**, Heidenheim, Germany; **Hans-Jürgen Wulz**, Heidenheim, Germany

[73] Assignee: **J. M. Voith GmbH**, Germany[21] Appl. No.: **55,918**[22] Filed: **Apr. 29, 1993****Related U.S. Application Data**

[63] Continuation of Ser. No. 773,965, filed as PCT/EP90/01313, Aug. 9, 1990, abandoned.

[30] **Foreign Application Priority Data**

Aug. 22, 1989 [DE] Germany 3927597

[51] Int. Cl.⁶ **D21F 1/00**[52] U.S. Cl. **162/301; 162/300**[58] Field of Search **162/203, 300, 301, 303, 162/348, 352**[56] **References Cited****U.S. PATENT DOCUMENTS**

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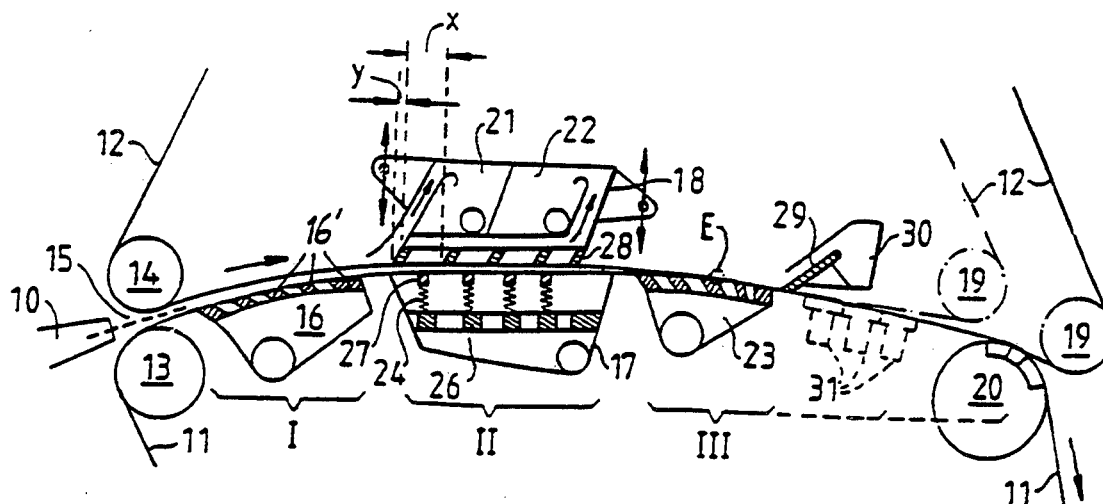
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Primary Examiner—Karen M. Hastings*Attorney, Agent, or Firm*—Ostrolenk, Faber, Gerb & Soffen

[57]

ABSTRACT

In a twin-wire former for the production of a paper web, two wire belts (11 and 12) together form a twin-wire zone which is divided into three sections (I, II and III). In the first section (I) the two wires (11, 12) travel over a curved forming shoe (16). They form there a wedge-shaped inlet slot (15) with which a headbox (10) is directly associated. In the second section (II), several resiliently supported strips (27) rest against the lower wire (11) and between each of said strips (27) a rigidly mounted strip (28) rests against the upper wire (12). In the third section (III) both wire belts (11, 12) pass over another curved forming shoe (23).

18 Claims, 2 Drawing Sheets

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Fig.1

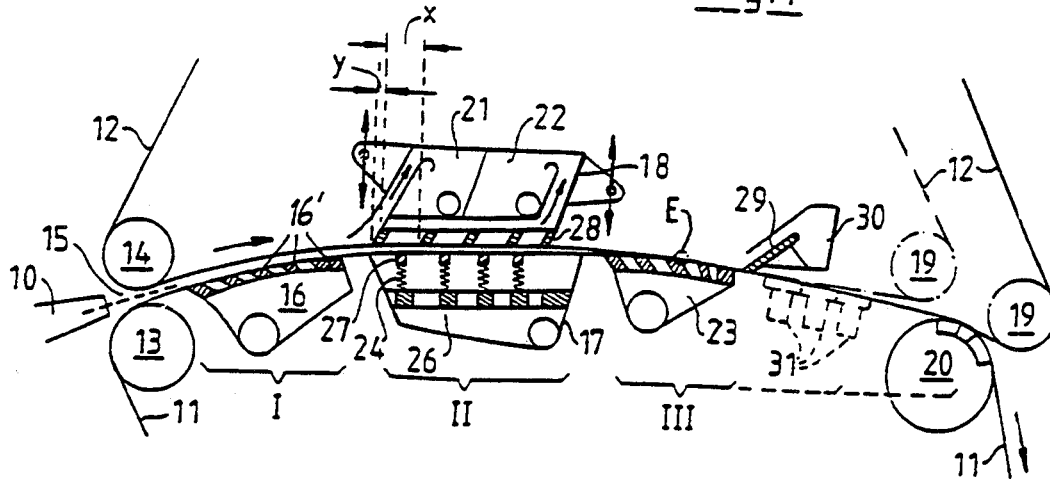


Fig.2

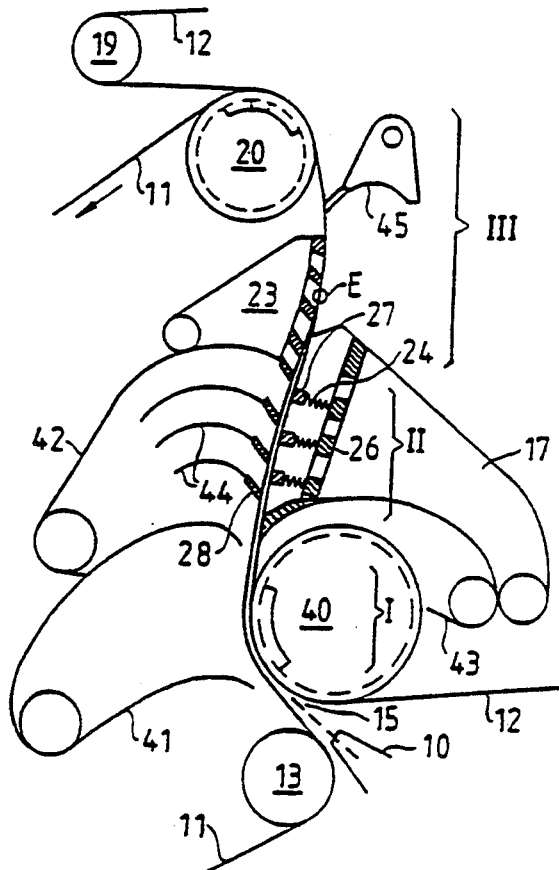
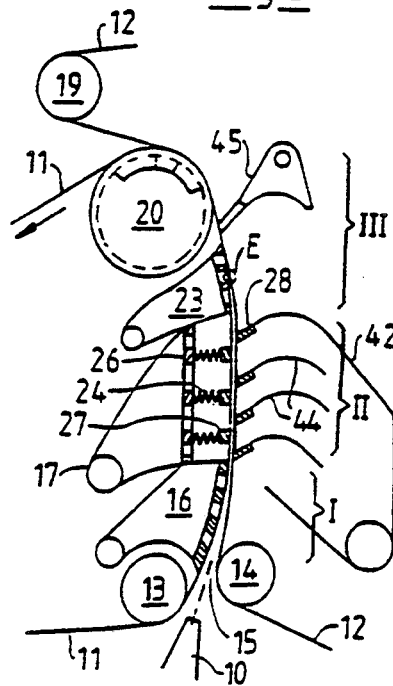


Fig.3

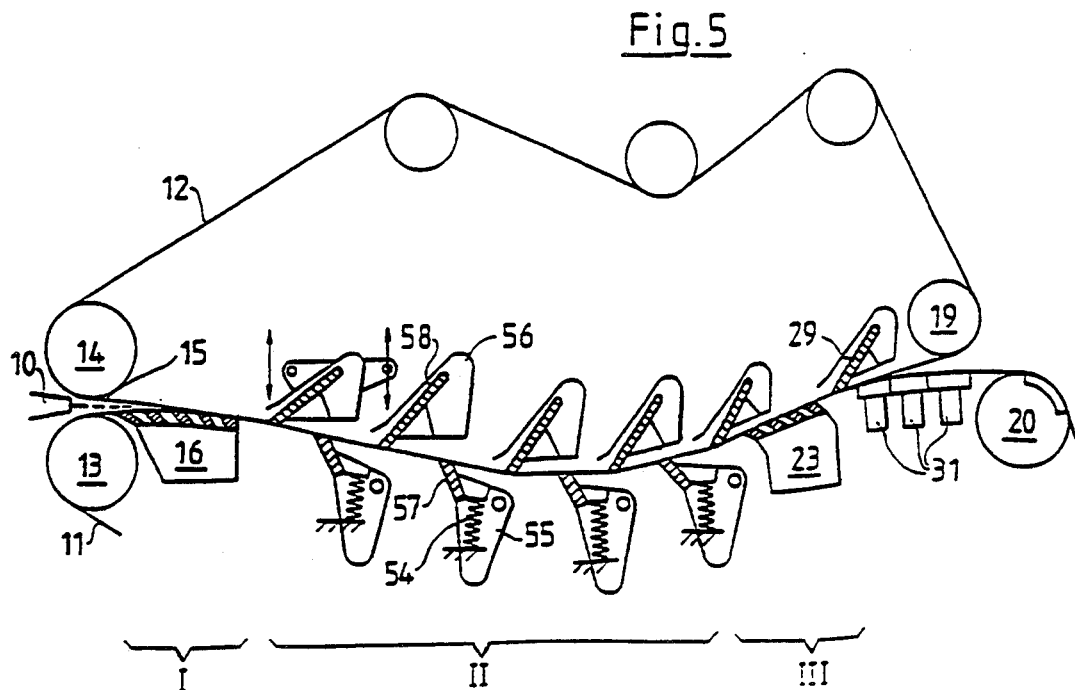
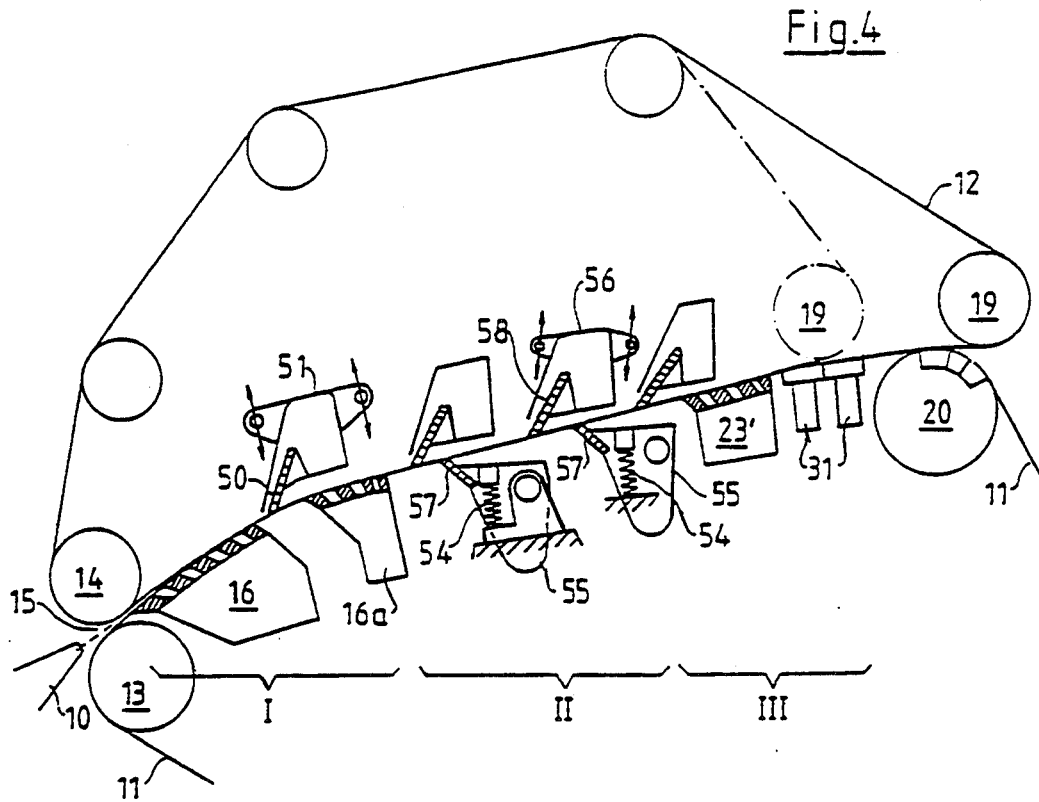


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TWIN WIRE FORMER

This is a continuation of application Ser. No. 07/773,965, filed as PCT/EP90/01313, Aug. 9, 1990, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to a twin-wire former for the production of a fiber web, in particular a paper web, from a fiber suspension. The invention proceeds from the basis of the twin-wire former known from British Patent 1 125 906. The features indicated in the patent include a twin wire former for producing a fiber web and particularly a paper web from a fiber suspension. Two web forming wire belts, in the form of endless loops, travel together to form a twin wire zone. The web travels between and along the path of the wire belts through the twin wire zone. The twin wire zone has three sections and the elements in those three sections are described below. The patent describes features that state, in other words, that the forming of the fiber web from the pulp suspension fed from the headbox takes place exclusively between two wire belts. Thus, there is no so-called single-wire pre-drainage path. In a first section of the twin-wire zone, the two wire belts together form a wedge-shaped inlet slot; a jet of pulp slurry coming from the headbox discharges into it. The jet strikes the two wire belts at a place where they pass over a curved drainage element; in the case of the aforementioned British patent, this is a stationary, curved forming shoe. Its curved wire guide surface is formed of a plurality of strips with drainage slots between them. This forming shoe is followed (in a second section of the twin-wire zone) by a drainage strip arranged in the other wire loop and, behind the latter, by a drainage strip arranged in the first-mentioned wire loop (and formed by a first suction box). Finally, in a third section of the twin-wire zone there are a plurality of stationary drainage elements developed as flat suction boxes.

It has been attempted for decades with twin-wire formers of the known type to produce fiber webs (in particular, paper webs) of the highest possible quality with relatively high operating speeds. Due to the forming of the web between two wires, the result, in particular, is obtained that the final fiber web has substantially the same properties on both sides (little "two-sidedness"). However, it is difficult to obtain as uniform as possible a distribution of the fibers in the final fiber web. In other words, it is difficult to obtain a good "formation" since while the web is formed, there is always the danger that fibers will agglomerate and form flocculations. Therefore, it is attempted to form a jet of pulp slurry which pulp slurry is as free as possible of flocculations in the headbox (for instance, by means of a turbulence producer). It is, furthermore, endeavored so to influence the drainage of the fiber suspension during the web-forming that "reflocculation" is avoided as far as possible or that, after possible flocculation, a "deflocculation" (i.e. a breaking up of the flocculations) takes place.

It is known that a curved drainage element arranged in the first section of the twin-wire zone and, in particular, a stationary curved forming shoe developed in accordance with the aforementioned British Patent 1 125 906 counteracts the danger of reflocculation. This is true also of the drainage strips arranged in the British Patent in the second section of the twin-wire zone. Nevertheless, the danger of reflocculation is not com-

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pletely eliminated in the arrangement according to said British Patent. Since the number of drainage strips there is very small, a large part of the web-forming takes place in the region of the following flat-suction boxes. They, to be sure, are of high drainage capacity so that the web-forming can be completed in the region of the last flat suction boxes (i.e. the so-called main drainage zone, in which a part of the fiber material is still in the form of a suspension, terminates in the region of the flat suction box). The flat suction boxes, however, are not able to avoid reflocculation or to break up flocculations which have already occurred.

In order to control these last-mentioned difficulties, a web-forming device known under the name of "Duo-former D" has been developed (TAPPI Proceedings 1988 annual meeting, pages 75 to 80). This known web-forming device is part of a twin-wire former which has a single-wire pre-drainage zone. In the twin-wire zone there are provided, in the one wire loop, a plurality of strips which are fixed in position but adjustably supported, namely, on the bottom of a suction box which drains in upward direction. Furthermore, a plurality of resiliently supported strips are provided in the other wire loop. By this resilience of the last-mentioned strips, the following result can be obtained: For example, upon an increase of the amount of suspension entering between the two wire belts, the flexibly supported strips can move away somewhat. In this way, the danger (which is present when only firmly supported strips are used) is eliminated of a backing up taking place in the fiber suspension in front of the strips. Such a backing up could destroy the fiber layers which have been formed up to then on the two wire belts. In other words, with this known web-forming device, a drainage pressure, once established, remains constant due to the resiliently supported strips even upon a change in the amount of suspension fed or upon a change in the drainage behavior of the fiber suspension. Therefore, automatic adaptation of the web-forming device to said changed conditions occurs.

With this known web-forming device, fiber webs of relatively good formation can also be formed. With respect to this, however, the demands have increased considerably recently, so that further improvements are desirable.

SUMMARY OF THE INVENTION

The object of the invention is so to develop a twin-wire of the aforementioned kind that the quality of the fiber web produced is further improved, particularly with respect to its formation (cloudiness), and that the twin-wire former can easily be adapted to different operating conditions (for instance, with regard to quantity and drainage behavior of the fiber suspension).

This object is achieved by the features set forth below. In particular, there is a respective drainage strip above each of the two wire belts in the second section of the twin wire zone, and at least one of the two drainage strips is supported resiliently against the respective wire belt while the other may or may not be resiliently supported, and typically is rigidly supported against the respective wire belt. Preferably, there are at least two of the drainage strips and often more against each of the wire belts. The drainage strips against one belt are offset along the path of the wire belts with respect to the drainage strips against the other belt, providing a zig zag or staggered array, and the drainage strips against at least one of the belts are resiliently supported.

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The inventors have found that a combination of known features, namely:

- A. Twin-wire former without a single-wire pre-drainage zone
- B. Start of the drainage in the twin-wire zone at a curved drainage element, for instance on a rotating forming cylinder or, even better, on a curved stationary forming shoe
- C. Further drainage in the twin-wire zone between strips which are arranged along a "zig-zag" line, the strips which rest against the one wire belt being resiliently supported,

leads to an extremely high increase in the quality of the finished fiber web, so that it satisfies even the highest requirements. At the same time, the twin-wire former of the invention is insensitive to changes in the amount of suspension fed and to changes in the drainage behavior of the fiber suspension. Experiments have shown that it is possible by the invention to obtain both a high increase in quality with respect to the formation and also good values with regard to the retention of fillers and fines. In contradistinction to this, in the known double-wire formers it is constantly found that there is a strong reduction in the retention upon an improvement in the formation.

It was, furthermore, found in experiments that in the second section of the twin-wire zone the number of strips can be considerably reduced as compared with the "Duoformer D". However, this number is substantially greater than in the case of the twin-wire former known from British Patent 1 125 906. It is advantageous to increase the distance between adjacent strips as compared with the "Duoformer D". In particular, the drainage strips above each one of the wire belts are of a thickness along the path of the wire belts and the spacing between adjacent strips above each wire belt is a minimum of about three times the strip thickness.

To be sure, from German OS 31 38 133, FIG. 3, a twin-wire former is known the twin-wire zone of which is provided in a first section with a curved stationary drainage element and in a second section with strips arranged along a "zig-zag" line, which strips may also be resiliently supported and there being a relatively large distance between them. However, in that case, in front of the twin-wire zone there is a single-wire pre-drainage zone in which the forming of the web starts initially only in a lower layer of the fiber suspension fed while the upper layer remains liquid and tends very strongly to flocculation. It has been found that these flakes cannot be broken up again to the desired extent in the following twin-wire zone. Another disadvantage is that the twin-wire zone is diverted by a guide roll behind the second section. This results (due to the so-called table-roll effect) in a further drainage which is uneven over the width of the web and thus in undesired variations in the quality of the web (recognizable, for instance, by disturbing longitudinal stripes).

BRIEF DESCRIPTION OF THE DRAWINGS

Other developments of the invention will be explained below with reference to embodiments which are shown in the drawing. Each of FIGS. 1 to 5 shows—in simplified diagrammatic form—one of the different embodiments.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The twin-wire former shown in FIG. 1 has a substantially horizontally extending twin-wire zone; this zone comprises three sections I, II and III arranged one behind the other. The endless wire belts (lower wire 11 and upper wire 12), shown only in part, travel in the direct vicinity of a headbox 10 over, in each case, a breast roll 13 and 14 respectively, so that the two wire belts together form a wedge-shaped entry slot 15 at the start of the twin-wire zone. The jet pulp discharged by the headbox 10 comes into contact with the two wire belts 11 and 12 only at the place where the lower wire 11 in the first section I of the twin-wire zone travels over a stationary curved forming shoe 16. The curved travel surface thereof is formed of several strips 16' with drainage slits present between them. The distance between the two breast rolls 13 and 14 is variable. The forming shoe 16 can be operated with or without vacuum.

In the second section II of the twin-wire zone, the two wire belts 11 and 12 (with the partially still liquid fiber suspension present between them) travel between a lower drainage box 17 and an upper drainage box 18. In the lower drainage box 17 there are a row of at least two strips 27 (preferably of approximately rectangular cross section) which are pressed from below resiliently against the lower wire 11. For this purpose, they are supported, for instance, on springs 24 (or pneumatic pressure cushions) on a, preferably water-permeable, plate. It is obvious that the force of the springs (or of the pressure prevailing in the pressure cushions) is individually adjustable.

The upper drainage box 18 is suspended on both the front and rear ends on vertically displaceable support elements as indicated diagrammatically by double arrows. On its lower side, there is a row of at least three strips 28 of preferably parallelogram cross section which rest against the upper side of the upper wire 12 and are rigidly attached to the box 18. Above the strips 28, a front vacuum chamber 21 and a rear vacuum chamber 22 are present in the drainage box 18. In the region of the forming shoe 16, a part of the water of the fiber suspension is led off downward; another part penetrates due to the tension of the upper wire 12—upwards through the upper wire and is deflected by the furthest in front of the strips 28 into the front vacuum chamber 21. The water passing upward between the upper strips 28 enters into the rear vacuum chamber 22. The water penetrating between the lower strips 27 through the lower wire 11 is led off downward. Between adjacent upper drainage strips 28 there is a minimum distance X of about three times the thickness Y of the strips. The same is true of the lower resiliently supported strips 27. It is important that each of the strips 27 and 28 lies in the region of a space between two opposite strips so that a "zig-zag" arrangement (i.e. non-opposing relationship) is present. Also, as seen in FIG. 1, the first one of the strips 28 is located upstream of the first one of the strips 27. The two wires 11 and 12 preferably travel on a straight path through section II. Gentle curvature of this section of the path is, however, also possible; see FIGS. 2 and 5. Differing from FIG. 1, the resiliently supported strips could also be arranged in the upper box 18 and the firmly supported strips in the lower box 17.

In the third section III of the twin-wire zone, both wire belts 11 and 12 travel over another curved forming

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shoe 23 which (as shown) is arranged preferably in the lower wire loop 11. Behind it, an additional strip 29 with vacuum chamber 30 can be arranged in the loop of the upper wire 12. Furthermore, flat suction boxes 31 can be present in the loop of the lower wire. There (as is shown by dash-dot lines) the upper wire 12 can be separated by means of a guide roll 19 from the lower wire 11 and from the fiber web formed. Lower wire and fiber web then travel over a wire suction roll 20. The guide roll 19 can, however, also lie further back, so that the upper wire 12 is separated from the lower wire 11 only on the wire suction roll 20.

It is important that two drainage boxes 17 and 18 with the alternately resiliently and firmly supported ledge strips 27 and 28 lie not in the front or the rear sections but in the middle section II of the twin-wire zone, since only here can they develop their full effect, namely, intensive drainage of the fiber suspension fed while retaining the fine flocculation-free fiber distribution. This is achieved in the manner that the corresponding wire belt is imparted a slight (scarcely visible) deflection on each strip so that turbulence is constantly produced in the still liquid part of the fiber pulp. For success it is, however, also decisive that previously, in section I, a known pre-drainage towards both sides has already taken place and that this also takes place with the greatest possible retention of the flocculation-free condition of the fiber suspension.

For this two-sided pre-drainage, a stationary curved forming shoe is provided in the first section I of the twin-wire zone (in accordance with FIGS. 1 and 3-5) whenever it is a question of satisfying the highest quality demands with respect to the formation. This effect of the forming shoe is due to the fact that at least the one wire belt travels polygonally from strip to strip, each strip not only leading water away but also producing turbulence in the pulp which is still liquid. With such a forming shoe, it is, however, difficult at times to obtain a stable operating condition upon the starting of the paper machine. Therefore, it may be advantageous to provide a known forming roll 40 in accordance with FIG. 2 in Section I instead of the stationary forming shoe and the breast roll lying in front of it. This possibility will be utilized when, in particular, the highest productivity is demanded from the paper manufacturing machine.

In the third section III, the aforementioned strip 29 can serve either solely to lead away water upwards or, in addition, for the further production of turbulence (for further improvement in quality). The latter is possible if a part of the fiber pulp is still in liquid condition at this place.

In FIGS. 1 to 3, the distance between the two wires 11 and 12 in the twin-wire zone has been shown greatly exaggerated. By this, it is intended to make it clear that the two wires 11 and 12 converge towards each other over a relatively long path within the twin-wire zone. This makes it clear that the process of web-forming on the first forming shoe 16 (in Section I) commences relatively slowly and is completed only in Section III. In this connection, the end of the main drainage zone in which the two wires converge towards each other (and thus, the end of the web-forming process) can lie approximately in the center of the wrapping zone of the second forming shoe 23, as is indicated, merely by way of example, in FIGS. 1 to 3. The end of the wire convergence is symbolically indicated there by the point E; the solids content of the paper web has reached there ap-

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proximately the value of 8%. This point can, however, also lie, for instance, on one of the flat suction boxes 31. Behind this point, it is attempted further to increase the solids content, if possible even before the separation of the two wires. One goal is, namely, for the separation of the wires to take place with the highest possible solids content of the web so that as few fibers as possible are torn out of the web upon the separation. The nature and number of the drainage elements necessary for this within the twin-wire zone may, however, differ greatly and is dependent, among other things, on the type of paper and the raw-material components thereof, as well as on the operating speed.

The embodiments shown in FIGS. 2 and 3 differ from the others primarily by the fact that the twin-wire zone rises substantially vertically upward in the direction of travel of the wires. In this way, the removal of the water withdrawn from the fiber suspension is simplified since the water can be discharged relatively uniformly towards both sides. No vacuum chambers are required in particular in the central section II of the twin-wire zone. To be sure, the forming roll 40 of FIG. 2 is, as a rule, developed as a suction roll. The forming shoes 16, 23, particularly those arranged in the third section III, can, if necessary, be provided with a suction device.

Further elements of the twin-wire former shown in FIG. 2 are water-collection containers 41, 42 and 43, guide plates 44 associated with the fixed strips 28, and a water removal strip 45. The other elements are provided with the same reference numbers as the corresponding elements in FIG. 1. The same is true with regard to FIG. 3. One possible modification of FIG. 3 can consist therein that, instead of the wire suction roll 20, a forming roll is provided, and instead of the guide roll 19 the wire suction roll. A similar arrangement is known from German Utility Model 88 06 036 (Voith File: P 4539). Aside from this exception and aside from the embodiment according to FIG. 2 (with forming roll 40), the invention will, however, be used whenever possible—so to design the twin-wire former that the relatively expensive forming roll (as to purchase and operation) can be dispensed with. Thus, as a rule, the wire suction roll 20 is present as the sole suction roll. Furthermore, in all embodiments of the invention it can be seen to it that no guide roll which deflects the twin-wire zone (and has the above-mentioned injurious table-roll effect) is present.

The embodiment of FIG. 4 differs from FIG. 1 among other things by the fact that, in the first section I of the twin-wire zone, a second curved stationary forming shoe 16a is arranged in the loop of the lower wire 11 behind and spaced from a first curved stationary forming shoe 16. Furthermore, in the loop of the upper wire 12 in the region between the two stationary forming shoes 16 and 16a there is provided an individual strip 50 which in known manner is part of a vacuum chamber 51. This vacuum chamber 51, similar to the upper drainage box 18 of FIG. 1, is suspended on its front and rear ends in vertically displaceable mounts. In this way, both the depth of penetration of the strip 50 into the path of travel of the upper wire 12 as well as the angle of attack of the strip 50 can be varied. With slight depth of penetration, the strip 50 serves solely for removal of water, while with greater depth of penetration it serves, in addition, for the production of turbulence in the suspension and, thus, for improvement of the formation. By the presence of two separate forming shoes 16 and 16a, the pre-drainage on both sides is temporarily

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interrupted; it is only continued after the strip 50 has removed from the upper wire 12 the water which has penetrated upward on the first forming shoe 16. In this way, higher operating speeds are possible.

Another difference from FIG. 1 is that, in the second section II of the twin-wire zone, the lower, flexibly supported strips 57 and the upper, firmly supported strips 58 are developed as individual strips. This means that each strip has its own supporting body 55/56. The lower strip-supporting bodies 55 are swingably mounted, the strip 57 being pressed resiliently by the force of springs 54 against the bottom of the lower wire 11. The supporting body 56 of each of the upper strips 58 is developed as vacuum chamber in the same way as that of the strip 50. The suspension of these vacuum chambers 56 corresponds to that of the vacuum chamber 51. It is important that each of the strips 57 and 58 rest with a given force of application (corresponding to the suspension pressure) against its wire belt 11 or 12. The strips 57 and 58 are adjusted in such a manner that a slight deflection of the wire belts takes place preferably on each strip. Due to the resilient supporting of the lower strips 57, the adjustment, once effected, is insensitive to changes in the quantity or quality of pulp, so that no backing up takes place in front of the strips and, nevertheless, an effective introduction of turbulence forces into the fiber suspension takes place. In contradistinction to FIGS. 1 to 3, there is the possibility of adjusting each one of the strips 57/58 individually with respect to position in height and inclination relative to the travel path of the wire. In this way, one can even better control the quality of the paper produced, with respect to both the formation and the nature of its surface (printability). Differing from FIG. 4, the upper strips 58 could be supported resiliently and the lower strips 57 stationary. Another alternative could consist therein that not only the upper strips 58 but also the lower strips 57 are fastened in vertically displaceable mounts (as shown on the vacuum chamber 51). In such case, the springs 54 might possibly be eliminated.

Another difference between FIGS. 1 and 4 resides in the fact that in FIG. 4 the twin-wire zone rises in the direction of travel of the wires upwards with an inclination of, on the average, about 20° with respect to the horizontal. In this way, it is possible to keep the entire height of the twin-wire former relatively slight. In the third section III of the twin-wire zone, a flat forming shoe 23' is provided rather than a curved one, differing from FIG. 1. The separation of the upper wire 12 from the lower wire and the fiber web formed can take place, as in FIG. 1, on one of the flat suction boxes 31. Instead of this, however, the upper wire 12 can also be conducted up to the wire suction roll 20. There, as shown, it can wrap around a small part (or, alternatively, a larger part) of the circumference of the wire suction roll 55 and then be returned via the reversing roll 19.

In the embodiment shown in FIG. 5, the twin-wire zone, as a whole, extends substantially in horizontal direction. The individual elements are substantially the same as in the embodiment of FIG. 4. However, there is the difference that the drainage strips 57 and 58 lying in the second section II of the twin-wire zone are arranged along a downwardly curved path of the twin-wire zone. Accordingly, an upwardly curved forming shoe 16, 23 is provided in the first section I and in the third section III of the twin-wire zone. This embodiment is advisable, in particular, for the modernizing of existing Fourdrinier paper machines.

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The embodiments shown have the feature in common that, in the second section II of the twin-wire zone, there are present preferably n flexibly supported strips 27/57 and $n+1$ rigidly supported strips. However, it is also possible to make the number of flexibly supported strips equal to or greater by one than the number of rigidly supported strips. Instead of a rigidly supported strip, a feed or discharge edge of a drainage box can also be provided. The minimum number n of flexibly supported strips is two (see FIG. 4). However, three or four flexibly supported strips are preferred.

What is claimed is:

1. A twin-wire former for the production of a paper web from a fiber suspension, the twin wire former comprising:

first and second web forming wire belts, means for directing the wire belts to travel along a path together for forming a twin wire zone of the twin wire former, with the web between the wire belts as the wire belts travel along the path through the twin wire zone, neither wire belt defining a single wire predrainage zone;

each wire belt forming an endless loop;

the twin wire zone having a first section at the start of the path through the twin wire zone, means for supporting the belts for forming a wedge shaped entrance slot into the first section, a fiber suspension supplying headbox having an outlet placed and directed for delivering fiber suspension from the headbox to the wedge shaped entrance slot of the first section of the twin wire zone; a curved drainage element in the first section, the curved drainage element having an open surface to enable drainage of water from the fiber suspension and being curved along the path of the belts through the twin wire zone, the curved drainage element being engaged by one of the wire belts, for curving the path of the belts around the curved drainage element after the entrance of the suspension into the entrance slot;

the twin wire zone having a second section following the first section along the path of the belts through the twin wire zone; in the second section, a plurality of first drainage strips are positioned within the loop of the first wire belt and are for contacting the first wire belt; in the second section, a plurality of second drainage strips are positioned within the loop of the second wire belt and are for contacting the second wire belt; the first strips being shifted in position along the path of the wire belts with respect to the second strips so that the first and second strips are offset and in a non-opposing relationship; first support means for resiliently supporting the first drainage strips against the respective wire belt that strip contacts;

second support means supporting the second drainage strips rigidly against the second wire belt;

the first drainage strips being located within the same wire belt loop as the curved drainage element and the second drainage strips being located within the other wire belt loop; the first one of the second drainage strips being located upstream of the first one of the first drainage strips and the last one of the second drainage strips being located downstream of the last one of the first drainage strips; means for supplying a vacuum in the area of the second drainage strips;

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the twin wire zone having a third section following the second section along the path of the wire belts through the twin wire zone; a stationary drainage element in the third section, for being engaged by one of the wire belts as the wire belts travel over the stationary drainage element, the stationary drainage element having an open surface to enable water to be drained through the wire belt in contact therewith; and

the twin wire zone being free of rolls which deflect the twin wire zone.

2. The twin wire former of claim 1, wherein each of the drainage strips has a respective "thickness in the direction along the path through the twin wire zone; neighboring ones of the first drainage strips are spaced a minimum distance of about three times the respective first strip thickness, and neighboring ones of the second drainage strips are also spaced a minimum distance of about three times the respective second strip thickness.

3. The twin wire former of claim 1, wherein the support means for the second drainage strips include means enabling adjustment of the position of the second drainage strips relative to the second wire belt to set the initial rigid position thereof.

4. The twin wire former of claim 3, wherein the support means for the second drainage strips comprise a support body to which the second drainage strips are supported, and bearings on which the support body is supported for enabling displacement of the support body across the path of the wire belts through the second section.

5. The twin wire former of claim 1, wherein the first and second support means comprise a respective individual support body supporting each of at least one of the first and second drainage strips individually, and means supporting the respective support body for each strip to be displaceable for enabling displacement of the respective strip transverse to the direction of the path of the wire belts.

6. The twin wire former of claim 1, wherein the first and second support means comprise a respective individual support body supporting each of the first and second drainage strips individually and means further supporting the respective support body of at least one of the first and second strips for enabling said at least one strip to be moved transverse to the direction of the path of the wire belts.

7. The twin wire former of claim 1, further comprising a curved stationary forming shoe in the first section of the twin wire zone and following after and spaced from the curved drainage element along the path of the wire belts through the first section;

a first section strip disposed at the second wire belt and in the space between the curved drainage element and the curved stationary forming shoe in the first section of the twin wire zone along the path of the wire belts through the twin wire zone for enabling removal of water from the second wire belt.

8. The twin wire former of claim 1, wherein the stationary drainage element in the third section of the twin wire zone has a curvature that is curved in the same

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direction as the curvature of the curved drainage element in the first section of the twin wire zone.

9. The twin wire former of claim 8, further comprising an additional strip in the third section of the twin wire zone following the stationary drainage element and disposed against the other wire belt than the stationary drainage element.

10. The twin wire former of claim 8, wherein the curved drainage element in the first section of the twin wire zone and the stationary drainage element in the third section of the twin wire zone are arranged against the same one of the first and second wire belts.

11. The twin wire former of claim 1, further comprising a suction roll at one of the wire belts and located after the stationary drainage element along the path of the wire belts; both of the wire belts being wrapped about part of the circumference of the suction roll.

12. The twin wire former of claim 1, wherein the means for directing the wire belts are positioned so that the twin wire zone rises substantially vertically upwardly in the path of travel of the wire belts through the twin wire zone.

13. The twin wire former of claim 1, wherein the means for directing the wire belts are positioned so that the twin wire zone rises gradually upwardly along the path of travel of the wire belts through the twin wire zone at an incline with respect to the horizontal in the range of about 10° to 30°.

14. The twin wire former of claim 1, wherein the first and the second drainage strips in the second section of the twin wire zone are both arranged one after the other along the path of the wire belts through the twin wire zone so as to define a curvature for the path of the wire belts through the second section.

15. The twin wire former of claim 14, wherein the first and second drainage strips are positioned in the second section of the twin wire zone to define a curvature for the path of the wire belts through the second section of the twin wire zone that is opposite the curvature of the curved drainage element in the first section of the twin wire zone.

16. The twin wire former of claim 1, wherein the means for directing the wire belts are positioned so that the twin wire zone extends substantially horizontally; the curved drainage element in the first section of the twin wire zone being generally curved upwardly for giving the path of the wire belts through the first section of the twin wire zone a generally upward curve; the first and second drainage strips in the second section of the twin wire zone being so positioned as to give the wire belts a generally downward curvature through at least part of the second section of the twin wire zone and the stationary drainage element in the third section of the twin wire zone is curved in a direction to give the wire belts passing through the third section of the twin wire zone a generally upward curvature.

17. The twin wire former of claim 1, wherein the stationary drainage element is curved.

18. The twin wire former of claim 1, wherein the stationary drainage element includes means for providing suction thereto to facilitate drainage of water.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 5,389,206
DATED : February 14, 1995
INVENTOR(S) : Rudolf Buck et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

On the title page in item [56] References Cited-U.S.
Patent Documents, change "3,994,744, 11/1976, Halme
et al." to --3,994,774, 11/1976, Halme et al.--

Signed and Sealed this
Second Day of April, 1996



BRUCE LEHMAN

Commissioner of Patents and Trademarks

Attest:

Attesting Officer

EXHIBIT E



US005500091A

United States Patent [19]
Bück et al.

[11] **Patent Number:** **5,500,091**
 [45] **Date of Patent:** ***Mar. 19, 1996**

[54] **TWIN-WIRE FORMER**

FOREIGN PATENT DOCUMENTS

[75] Inventors: **Rudolf Bück; Dieter Egelhof; Klaus Hensler**, all of Heidenheim, Germany; **Werner Kade**, Neenah, Wis.; **Albrecht Meinecke**, Heidenheim, Germany; **Wilhelm Wanke**, Heidenheim, Germany; **Hans-Jürgen Wulz**, Heidenheim, Germany

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[73] Assignee: **J. M. Voith GmbH**, Germany

[*] Notice: The portion of the term of this patent shall not extend beyond the expiration date of Pat. No. 5,389,206.

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[21] Appl. No.: **286,948**

[22] Filed: **Aug. 8, 1994**

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Related U.S. Application Data

[63] Continuation of Ser. No. 55,918, Apr. 29, 1993, Pat. No. 5,389,206, which is a continuation of Ser. No. 773,965, Nov. 12, 1991, abandoned.

Primary Examiner—Karen M. Hastings

Attorney, Agent, or Firm—Ostrolenk, Faber, Gerb & Soffen

[30] **Foreign Application Priority Data**

Aug. 22, 1989 [DE] Germany 39 27 597.3

[51] **Int. Cl.⁶** **D21F 1/00**

[52] **U.S. Cl.** **162/301; 162/300**

[58] **Field of Search** 162/203, 300,
 162/301, 303, 348, 352

[57]

ABSTRACT

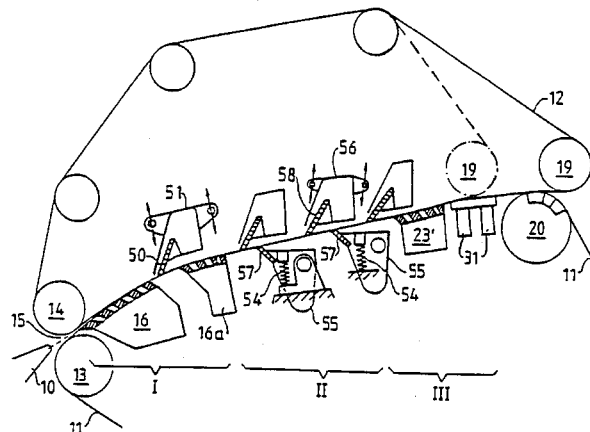
In a twin-wire former for the production of a paper web, two wire belts (11 and 12) together form a twin-wire zone which is divided into three sections (I, II and III). In the first section (I) the two wires (11, 12) travel over a curved forming shoe (16). They form there a wedge-shaped inlet slot (15) with which a headbox (10) is directly associated. In the second section (II), several resiliently supported strips (27) rest against the lower wire (11) and between each of said strips (27) a rigidly mounted strip (28) rests against the upper wire (12). In the third section (III) both wire belts (11, 12) pass over another curved forming shoe (23).

[56] **References Cited**

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2 Claims, 2 Drawing Sheets



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Fig.1

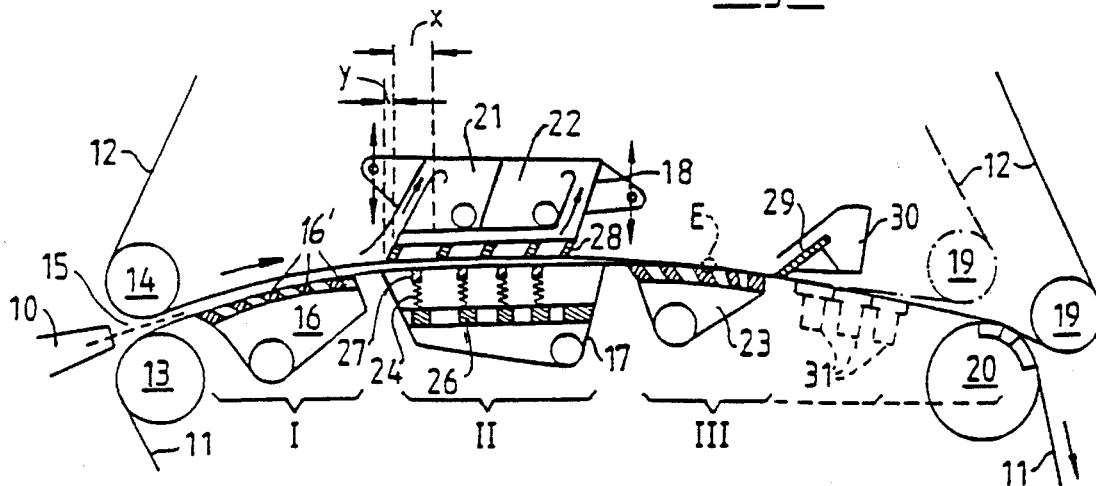


Fig.2

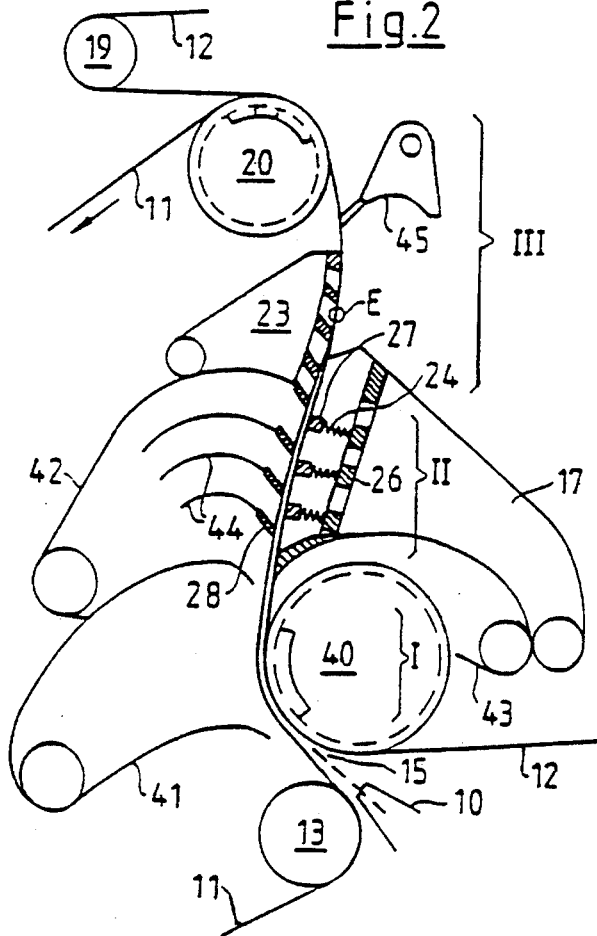
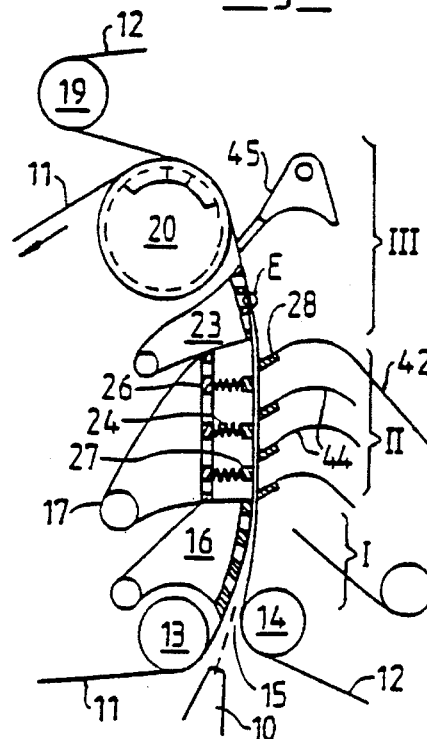


Fig.3

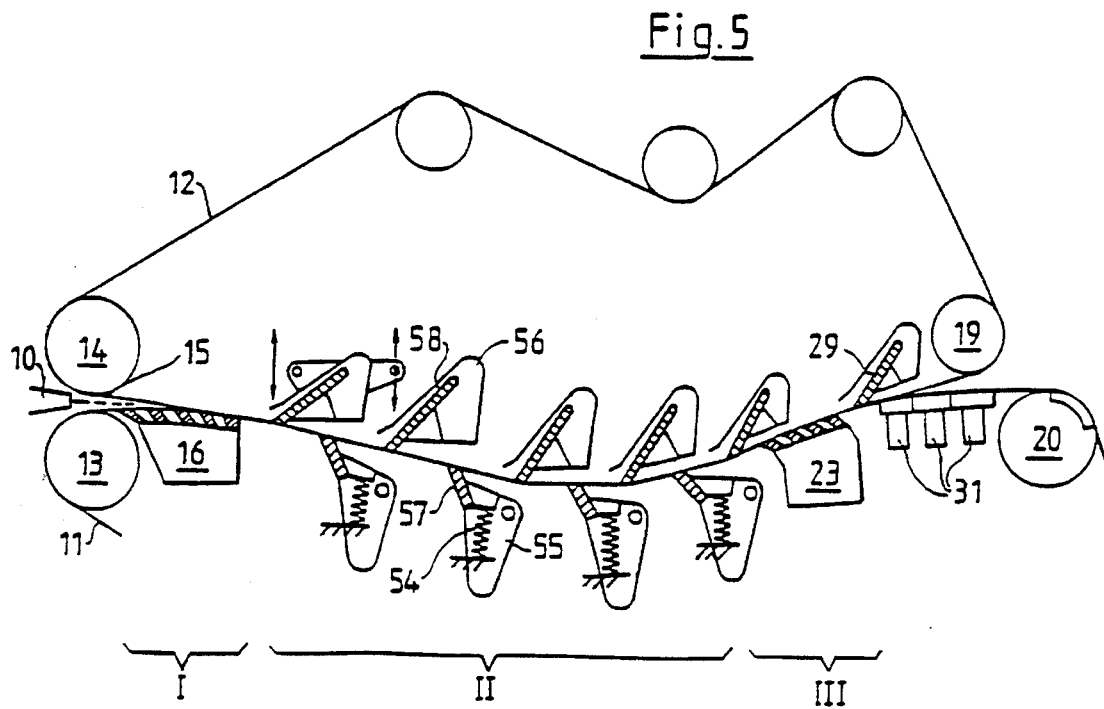
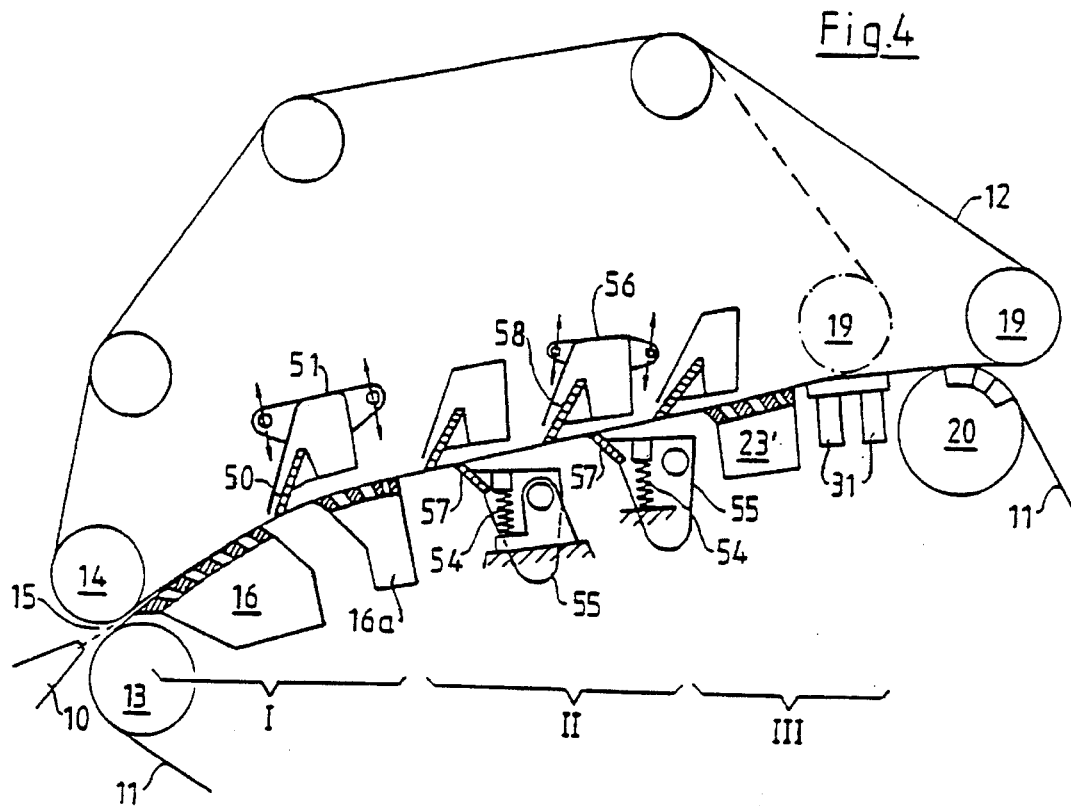


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TWIN-WIRE FORMER

This is a continuation of patent application Ser. No. 08/055,918, filed Apr. 29, 1993, now U.S. Pat. No. 5,389, 206 which is a continuation of patent application Ser. No. 07/773,965, filed Nov. 12, 1991, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to a twin-wire former for the production of a fiber web, in particular a paper web, from a fiber suspension. The invention proceeds from the basis of the twin-wire former known from British Patent 1 125 906. The features indicated in the patent include a twin wire former for producing a fiber web and particularly a paper web from a fiber suspension. Two web forming wire belts, in the form of endless loops, travel together to form a twin wire zone. The web travels between and along the path of the wire belts through the twin wire zone. The twin wire zone has three sections and the elements in those three sections are described below. The patent describes features that state, in other words, that the forming of the fiber web from the pulp suspension fed from the headbox takes place exclusively between two wire belts. Thus, there is no so-called single-wire pre-drainage path. In a first section of the twin-wire zone, the two wire belts together form a wedge-shaped inlet slot; a jet of pulp slurry coming from the headbox discharges into it. The jet strikes the two wire belts at a place where they pass over a curved drainage element; in the case of the aforementioned British patent, this is a stationary, curved forming shoe. Its curved wire guide surface is formed of a plurality of strips with drainage slots between them. This forming shoe is followed (in a second section of the twin-wire zone) by a drainage strip arranged in the other wire loop and, behind the latter, by a drainage strip arranged in the first-mentioned wire loop (and formed by a first suction box). Finally, in a third section of the twin-wire zone there are a plurality of stationary drainage elements developed as flat suction boxes.

It has been attempted for decades with twin-wire formers of the known type to produce fiber webs (in particular, paper webs) of the highest possible quality with relatively high operating speeds. Due to the forming of the web between two wires, the result, in particular, is obtained that the final fiber web has substantially the same properties on both sides (little "two-sidedness"). However, it is difficult to obtain as uniform as possible a distribution of the fibers in the final fiber web. In other words, it is difficult to obtain a good "formation", since, while the web is formed, there is always the danger that fibers will agglomerate and form flocculations. Therefore, it is attempted to form a jet of pulp slurry which pulp slurry is as free as possible of flocculations in the headbox (for instance, by means of a turbulence producer). It is, furthermore, endeavored so to influence the drainage of the fiber suspension during the web-forming that "reflocculation" is avoided as far as possible or that, after possible flocculation, a "deflocculation" (i.e. a breaking up of the flocculations) takes place.

It is known that a curved drainage element arranged in the first section of the twin-wire zone and, in particular, a stationary curved forming shoe developed in accordance with the aforementioned British Patent 1 125 906 counteracts the danger of reflocculation. This is true also of the drainage strips arranged in the British Patent in the second section of the twin-wire zone. Nevertheless, the danger of reflocculation is not completely eliminated in the arrangement according to said British Patent. Since the number of

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drainage strips there is very small, a large part of the web-forming takes place in the region of the following flat-suction boxes. They, to be sure, are of high drainage capacity so that the web-forming can be completed in the region of the last flat suction boxes (i.e. the so-called main drainage zone, in which a part of the fiber material is still in the form of a suspension, terminates in the region of the flat suction box). The flat suction boxes, however, are not able to avoid reflocculation or to break up flocculations which have already occurred.

In order to control these last-mentioned difficulties, a web-forming device known under the name of "Duoformer D" has been developed (TAPPI Proceedings 1988 annual meeting, pages 75 to 80). This known web-forming device is part of a twin-wire former which has a single-wire pre-drainage zone. In the twin-wire zone there are provided, in the one wire loop, a plurality of strips which are fixed in position but adjustably supported, namely, on the bottom of a suction box which drains in upward direction. Furthermore, a plurality of resiliently supported strips are provided in the other wire loop. By this resilience of the last-mentioned strips, the following result can be obtained: For example, upon an increase of the amount of suspension entering between the two wire belts, the flexibly supported strips can move away somewhat. In this way, the danger (which is present when only firmly supported strips are used) is eliminated of a backing up taking place in the fiber suspension in front of the strips. Such a backing up could destroy the fiber layers which have been formed up to then on the two wire belts. In other words, with this known web-forming device, a drainage pressure, once established, remains constant due to the resiliently supported strips even upon a change in the amount of suspension fed or upon a change in the drainage behavior of the fiber suspension. Therefore, automatic adaptation of the web-forming device to said changed conditions occurs.

With this known web-forming device, fiber webs of relatively good formation can also be formed. With respect to this, however, the demands have increased considerably recently, so that further improvements are desirable.

SUMMARY OF THE INVENTION

The object of the invention is so to develop a twin-wire of the aforementioned kind that the quality of the fiber web produced is further improved, particularly with respect to its formation (cloudiness), and that the twin-wire former can easily be adapted to different operating conditions (for instance, with regard to quantity and drainage behavior of the fiber suspension).

This object is achieved by the features set forth below. In particular, there is a respective drainage strip above each of the two wire belts in the second section of the twin wire zone, and at least one of the two drainage strips is supported resiliently against the respective wire belt while the other may or may not be resiliently supported, and typically is rigidly supported against the respective wire belt. Preferably, there are at least two of the drainage strips and often more against each of the wire belts. The drainage strips against one belt are offset along the path of the wire belts with respect to the drainage strips against the other belt, providing a zig zag or staggered array, and the drainage strips against at least one of the belts are resiliently supported.

The inventors have found that a combination of known features, namely:

A. Twin-wire former without a single-wire pre-drainage zone

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B. Start of the drainage in the twin-wire zone at a curved drainage element, for instance on a rotating forming cylinder or, even better, on a curved stationary forming shoe

C. Further drainage in the twin-wire zone between strips which are arranged along a "zig-zag" line, the strips which rest against the one wire belt being resiliently supported,

leads to an extremely high increase in the quality of the finished fiber web, so that it satisfies even the highest requirements. At the same time, the twin-wire former of the invention is insensitive to changes in the amount of suspension fed and to changes in the drainage behavior of the fiber suspension. Experiments have shown that it is possible by the invention to obtain both a high increase in quality with respect to the formation and also good values with regard to the retention of fillers and fines. In contradistinction to this, in the known double-wire formers it is constantly found that there is a strong reduction in the retention upon an improvement in the formation.

It was, furthermore, found in experiments that in the second section of the twin-wire zone the number of strips can be considerably reduced as compared with the "Duo-former D". However, this number is substantially greater than in the case of the twin-wire former known from British Patent 1 125 906. It is advantageous to increase the distance between adjacent strips as compared with the "Duoformer D". In particular, the drainage strips above each one of the wire belts are of a thickness along the path of the wire belts and the spacing between adjacent strips above each wire belt is a minimum of about three times the strip thickness.

To be sure, from German OS 31 38 133, FIG. 3, a twin-wire former is known the twin-wire zone of which is provided in a first section with a curved stationary drainage element and in a second section with strips arranged along a "zig-zag" line, which strips may also be resiliently supported and there being a relatively large distance between them. However, in that case, in front of the twin-wire zone there is a single-wire pre-drainage zone in which the forming of the web starts initially only in a lower layer of the fiber suspension fed while the upper layer remains liquid and tends very strongly to flocculation. It has been found that these flakes cannot be broken up again to the desired extent in the following twin-wire zone. Another disadvantage is that the twin-wire zone is diverted by a guide roll (14b) behind the second section. This results (due to the so-called table-roll effect) in a further drainage which is uneven over the width of the web and thus in undesired variations in the quality of the web (recognizable, for instance, by disturbing longitudinal stripes).

BRIEF DESCRIPTION OF THE DRAWINGS

Other developments of the invention will be explained below with reference to embodiments which are shown in the drawing. Each of FIGS. 1 to 5 shows—in simplified diagrammatic form—one of the different embodiments.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The twin-wire former shown in FIG. 1 has a substantially horizontally extending twin-wire zone; this zone comprises three sections I, II and III arranged one behind the other. The endless wire belts (lower wire 11 and upper wire 12), shown only in part, travel in the direct vicinity of a headbox 10 over, in each case, a breast roll 13 and 14 respectively, so

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that the two wire belts together form a wedge-shaped entry slot 15 at the start of the twin-wire zone. The jet pulp discharged by the headbox 10 comes into contact with the two wire belts 11 and 12 only at the place where the lower wire 11 in the first section I of the twin-wire zone travels over a stationary curved forming shoe 16. The curved travel surface thereof is formed of several strips 16' with drainage slits present between them. The distance between the two breast rolls 13 and 14 is variable. The forming shoe 16 can be operated with or without vacuum.

In the second section II of the twin-wire zone, the two wire belts 11 and 12 (with the partially still liquid fiber suspension present between them) travel between a lower drainage box 17 and an upper drainage box 18. In the lower drainage box 17 there are a row of at least two strips 27 (preferably of approximately rectangular cross section) which are pressed from below resiliently against the lower wire 11. For this purpose, they are supported, for instance, on springs 24 (or pneumatic pressure cushions) on a, preferably water-permeable, plate. It is obvious that the force of the springs (or of the pressure prevailing in the pressure cushions) is individually adjustable.

The upper drainage box 18 is suspended on both the front and rear ends on vertically displaceable support elements as indicated diagrammatically by double arrows. On its lower side, there is a row of at least three strips 28 of preferably parallelogram cross section which rest against the upper side of the upper wire 12 and are rigidly attached to the box 18. Above the strips 28, a front vacuum chamber 21 and a rear vacuum chamber 22 are present in the drainage box 18. In the region of the forming shoe 16, a part of the water of the fiber suspension is led off downward; another part penetrates due to the tension of the upper wire 12—upwards through the upper wire and is deflected by the furthest in front of the strips 28 into the front vacuum chamber 21. The water passing upward between the upper strips 28 enters into the rear vacuum chamber 22. The water penetrating between the lower strips 27 through the lower wire 11 is led off downward. Between adjacent upper drainage strips 28 there is a minimum distance X of about three times the thickness Y of the strips. The same is true of the lower resiliently supported strips 27. It is important that each of the strips 27 and 28 lies in the region of a space between two opposite strips so that a "zig-zag" arrangement (i.e. non-opposing relationship) is present. Also, as seen in FIG. 1, the first one of the strips 28 is located upstream of the first one of the strips 27. The two wires 11 and 12 preferably travel on a straight path through section II. Gentle curvature of this section of the path is, however, also possible; see FIGS. 2 and 5. Differing from FIG. 1, the resiliently supported strips could also be arranged in the upper box 18 and the firmly supported strips in the lower box 17.

In the third section III of the twin-wire zone, both wire belts 11 and 12 travel over another curved forming shoe 23 which (as shown) is arranged preferably in the lower wire loop 11. Behind it, an additional strip 29 with vacuum chamber 30 can be arranged in the loop of the upper wire 12. Furthermore, flat suction boxes 31 can be present in the loop of the lower wire. There (as is shown by dash-dot lines) the upper wire 12 can be separated by means of a guide roll 19 from the lower wire 11 and from the fiber web formed. Lower wire and fiber web then travel over a wire suction roll 20. The guide roll 19 can, however, also lie further back, so that the upper wire 12 is separated from the lower wire 11 only on the wire suction roll 20.

It is important that two drainage boxes 17 and 18 with the alternately resiliently and firmly supported ledge strips 27

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and 28 lie not in the front or the rear sections but in the middle section II of the twin-wire zone, since only here can they develop their full effect, namely, intensive drainage of the fiber suspension fed while retaining the fine flocculation-free fiber distribution. This is achieved in the manner that the corresponding wire belt is imparted a slight (scarcely visible) deflection on each strip so that turbulence is constantly produced in the still liquid part of the fiber pulp. For success it is, however, also decisive that previously, in section I, a known pre-drainage towards both sides has already taken place and that this also takes place with the greatest possible retention of the flocculation-free condition of the fiber suspension.

For this two-sided pre-drainage, a stationary curved forming shoe is provided in the first section I of the twin-wire zone (in accordance with FIGS. 1 and 3-5) whenever it is a question of satisfying the highest quality demands with respect to the formation. This effect of the forming shoe is due to the fact that at least the one wire belt travels polygonally from strip to strip, each strip not only leading water away but also producing turbulence in the pulp which is still liquid. With such a forming shoe, it is, however, difficult at times to obtain a stable operating condition upon the starting of the paper machine. Therefore, it may be advantageous to provide a known forming roll 40 in accordance with FIG. 2 in Section I instead of the stationary forming shoe and the breast roll lying in front of it. This possibility will be utilized when, in particular, the highest productivity is demanded from the paper manufacturing machine.

In the third section III, the aforementioned strip 29 can serve either solely to lead away water upwards or, in addition, for the further production of turbulence (for further improvement in quality). The latter is possible if a part of the fiber pulp is still in liquid condition at this place.

In FIGS. 1 to 3, the distance between the two wires 11 and 12 in the twin-wire zone has been shown greatly exaggerated. By this, it is intended to make it clear that the two wires 11 and 12 converge towards each other over a relatively long path within the twin-wire zone. This makes it clear that the process of web-forming on the first forming shoe 16 (in Section I) commences relatively slowly and is completed only in Section III. In this connection, the end of the main drainage zone in which the two wires converge towards each other (and thus, the end of the web-forming process) can lie approximately in the center of the wrapping zone of the second forming shoe 23, as is indicated, merely by way of example, in FIGS. 1 to 3. The end of the wire convergence is symbolically indicated there by the point E; the solids content of the paper web has reached there approximately the value of 8%. This point can, however, also lie, for instance, on one of the flat suction boxes 31. Behind this point, it is attempted further to increase the solids content, if possible even before the separation of the two wires. One goal is, namely, for the separation of the wires to take place with the highest possible solids content of the web so that as few fibers as possible are torn out of the web upon the separation. The nature and number of the drainage elements necessary for this within the twin-wire zone may, however, differ greatly and is dependent, among other things, on the type of paper and the raw-material components thereof, as well as on the operating speed.

The embodiments shown in FIGS. 2 and 3 differ from the others primarily by the fact that the twin-wire zone rises substantially vertically upward in the direction of travel of the wires. In this way, the removal of the water withdrawn from the fiber suspension is simplified since the water can be

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discharged relatively uniformly towards both sides. No vacuum chambers are required in particular in the central section II of the twin-wire zone. To be sure, the forming roll 40 of FIG. 2 is, as a rule, developed as a suction roll. The forming shoes 16, 23, particularly those arranged in the third section III, can, if necessary, be provided with a suction device.

Further elements of the twin-wire former shown in FIG. 2 are water-collection containers 41, 42 and 43, guide plates 44 associated with the fixed strips 28, and a water removal strip 45. The other elements are provided with the same reference numbers as the corresponding elements in FIG. 1. The same is true with regard to FIG. 3. One possible modification of FIG. 3 can consist therein that, instead of the wire suction roll 20, a forming roll is provided, and instead of the guide roll 19 the wire suction roll. A similar arrangement is known from German Utility Model 88 06 036 (Voith File: P 4539). Aside from this exception and aside from the embodiment according to FIG. 2 (with forming roll 40), the invention will, however, be used— whenever possible—so to design the twin-wire former that the relatively expensive forming roll (as to purchase and operation) can be dispensed with. Thus, as a rule, the wire suction roll 20 is present as the sole suction roll. Furthermore, in all embodiments of the invention it can be seen to it that no guide roll which deflects the twin-wire zone (and has the above-mentioned injurious table-roll effect) is present.

The embodiment of FIG. 4 differs from FIG. 1 among other things by the fact that, in the first section I of the twin-wire zone, a second curved stationary forming shoe 16a is arranged in the loop of the lower wire 11 behind and spaced from a first curved stationary forming shoe 16. Furthermore, in the loop of the upper wire 12 in the region between the two stationary forming shoes 16 and 16a there is provided an individual strip 50 which in known manner is part of a vacuum chamber 51. This vacuum chamber 51, similar to the upper drainage box 18 of FIG. 1, is suspended on its front and rear ends in vertically displaceable mounts. In this way, both the depth of penetration of the strip 50 into the path of travel of the upper wire 12 as well as the angle of attack of the strip 50 can be varied. With slight depth of penetration, the strip 50 serves solely for removal of water, while with greater depth of penetration it serves, in addition, for the production of turbulence in the suspension and, thus, for improvement of the formation. By the presence of two separate forming shoes 16 and 16a, the pre-drainage on both sides is temporarily interrupted; it is only continued after the strip 50 has removed from the upper wire 12 the water which has penetrated upward on the first forming shoe 16. In this way, higher operating speeds are possible.

Another difference from FIG. 1 is that, in the second section II of the twin-wire zone, the lower, flexibly supported strips 57 and the upper, firmly supported strips 58 are developed as individual strips. This means that each strip has its own supporting body 55/56. The lower strip-supporting bodies 55 are swingably mounted, the strip 57 being pressed resiliently by the force of springs 54 against the bottom of the lower wire 11. The supporting body 56 of each of the upper strips 58 is developed as vacuum chamber in the same way as that of the strip 50. The suspension of these vacuum chambers 56 corresponds to that of the vacuum chamber 51. It is important that each of the strips 57 and 58 rest with a given force of application (corresponding to the suspension pressure) against its wire belt 11 or 12. The strips 57 and 58 are adjusted in such a manner that a slight deflection of the wire belts takes place preferably on each strip. Due to the resilient supporting of the lower strips 57, the adjustment,

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once effected, is insensitive to changes in the quantity or quality of pulp, so that no backing up takes place in front of the strips and, nevertheless, an effective introduction of turbulence forces into the fiber suspension takes place. In contradistinction to FIGS. 1 to 3, there is the possibility of adjusting each one of the strips 57/58 individually with respect to position in height and inclination relative to the travel path of the wire. In this way, one can even better control the quality of the paper produced, with respect to both the formation and the nature of its surface (printability). Differing from FIG. 4, the upper strips 58 could be supported resiliently and the lower strips 57 stationary. Another alternative could consist therein that not only the upper strips 58 but also the lower strips 57 are fastened in vertically displaceable mounts (as shown on the vacuum chamber 51). In such case, the springs 54 might possibly be eliminated.

Another difference between FIGS. 1 and 4 resides in the fact that in FIG. 4 the twin-wire zone rises in the direction of travel of the wires upwards with an inclination of, on the average, about 20° with respect to the horizontal. In this way, it is possible to keep the entire height of the twin-wire former relatively slight. In the third section III of the twin-wire zone, a flat forming shoe 23' is provided rather than a curved one, differing from FIG. 1. The separation of the upper wire 12 from the lower wire and the fiber web formed can take place, as in FIG. 1, on one of the flat suction boxes 31. Instead of this, however, the upper wire 12 can also be conducted up to the wire suction roll 20. There, as shown, it can wrap around a small part (or, alternatively, a larger part) of the circumference of the wire suction roll and then be returned via the reversing roll 19.

In the embodiment shown in FIG. 5, the twin-wire zone, as a whole, extends substantially in horizontal direction. The individual elements are substantially the same as in the embodiment of FIG. 4. However, there is the difference that the drainage strips 57 and 58 lying in the second section II of the twin-wire zone are arranged along a downwardly curved path of the twin-wire zone. Accordingly, an upwardly curved forming shoe 16, 23 is provided in the first section I and in the third section III of the twin-wire zone. This embodiment is advisable, in particular, for the modernizing of existing Fourdrinier paper machines.

The embodiments shown have the feature in common that, in the second section II of the twin-wire zone, there are present preferably n flexibly supported strips 27/57 and n+1 rigidly supported strips. However, it is also possible to make the number of flexibly supported strips equal to or greater by one than the number of rigidly supported strips. Instead of a rigidly supported strip, a feed or discharge edge of a drainage box can also be provided. The minimum number n of flexibly supported strips is two (see FIG. 4). However, three or four flexibly supported strips are preferred.

What is claimed is:

1. A twin-wire former for the production of a paper web from a fiber suspension, the twin wire former comprising:
 - first and second web forming wire belts, means for directing the wire belts to travel along a path together for forming a twin wire zone of the twin wire former, with the web between the wire belts as the wire belts travel along the path through the twin wire zone, neither wire belt defining a single wire predrainage zone;
 - each wire belt forming an endless loop;
 - the twin wire zone having a first section at the start of the path through the twin wire zone, means for supporting the belts for forming a wedge shaped entrance slot into

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the first section, a fiber suspension supplying headbox having an outlet placed and directed for delivering fiber suspension from the headbox to the wedge shaped entrance slot of the first section of the twin wire zone; a curved drainage element in the first section, the curved drainage element having an open surface to enable drainage of water from the fiber suspension and being curved along the path of the belts through the twin wire zone, the curved drainage element being engaged by one of the wire belts, for curving the path of the belts around the curved drainage element after the entrance of the suspension into the entrance slot;

the twin wire zone having a second section following the first section along the path of the belts through the twin wire zone; in the second section, a plurality of first drainage strips are positioned within the loop of the first wire belt and are for contacting the first wire belt; in the second section, a plurality of second drainage strips are positioned within the loop of the second wire belt and are for contacting the second wire belt; the first strips being shifted in position along the path of the wire belts with respect to the second strips so that the first and second strips are offset and in a non-opposing relationship; first support means for resiliently supporting the first drainage strips against the respective wire belt that strip contacts;

second support means supporting the second drainage strips rigidly against the second wire belt;

the first drainage strips being located within the same wire belt loop as the curved drainage element and the second drainage strips being located within the other wire belt loop; the first one of the second drainage strips being located upstream of the first one of the first drainage strips and the last one of the second drainage strips being located downstream of the last one of the first drainage strips;

means for supplying a vacuum in the area of the second drainage strips;

the twin wire zone having a third section following the second section along the path of the wire belts through the twin wire zone; a drainage element in the third section, for being engaged by one of the wire belts as the wire belts travel over the drainage element, the drainage element having an open surface to enable water to be drained through the wire belt in contact therewith; and

the twin wire zone being free of rolls which deflect the twin wire zone.

2. A twin-wire former for the production of a paper web from a fiber suspension, the twin wire former comprising:

first and second web forming wire belts, means for directing the wire belts to travel along a path together for forming a twin wire zone of the twin wire former, with the web between the wire belts as the wire belts travel along the path through the twin wire zone, neither wire belt defining a single wire predrainage zone;

each wire belt forming an endless loop;

the twin wire zone having a first section at the start of the path through the twin wire zone, means for supporting the belts for forming a wedge shaped entrance slot into the first section, a fiber suspension supplying headbox having an outlet placed and directed for delivering fiber suspension from the headbox to the wedge shaped entrance slot of the first section of the twin wire zone; a curved drainage element in the first section, the

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curved drainage element having an open surface to enable drainage of water from the fiber suspension and being curved along the path of the belts through the twin wire zone, the curved drainage element being engaged by one of the wire belts, for curving the path of the belts around the curved drainage element after the entrance of the suspension into the entrance slot;

the twin wire zone having a second section following the first section along the path of the belts through the twin wire zone; in the second section, a plurality of first drainage strips are positioned within the loop of the first wire belt and are for contacting the first wire belt; in the second section, a plurality of second drainage strips are positioned within the loop of the second wire belt and are for contacting the second wire belt; the first strips being shifted in position along the path of the wire belts with respect to the second strips so that the first and second strips are offset and in a non-opposing relationship; first support means for resiliently supporting the first drainage strips against the respective wire belt that strip contacts;

second support means supporting the second drainage strips rigidly against the second wire belt;

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the first drainage strips being located within the same wire belt loop as the curved drainage element and the second drainage strips being located within the other wire belt loop; the first one of the second drainage strips being located upstream of the first one of the first drainage strips and the last one of the second drainage strips being located downstream of the last one of the first drainage strips;

means for supplying a vacuum in the area of the second drainage strips;

the twin wire zone having a third section following the second section along the path of the wire belts through the twin wire zone; a drainage element in the third section, for being engaged by one of the wire belts as the wire belts travel over the stationary drainage element, the drainage element having an open surface to enable water to be drained through the wire belt in contact therewith; and

the twin wire zone being free of any forming rolls.

* * * * *

EXHIBIT F



US005853544A

United States Patent

[19]

[11] **Patent Number:** **5,853,544****Egelhof et al.**[45] **Date of Patent:** **Dec. 29, 1998**[54] **TWIN WIRE FORMER**

[75] Inventors: **Dieter Egelhof; Klaus Henseler**, both of Heidenheim, Germany; **Werner Kade**, Neenah, Wis.; **Albrecht Meinecke**, Heidenheim, Germany; **Wilhelm Wanke**, Heidenheim, Germany; **Hans-Jurgen Wulz**, Heidenheim, Germany; **Rudolf Bück**, deceased, late of Heidenheim, Germany, by Else Bück, executor

[73] Assignee: **J.M. Voith GmbH**, Germany[21] Appl. No.: **23,435**[22] Filed: **Feb. 13, 1998**

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Primary Examiner—Karen M. Hastings

Attorney, Agent, or Firm—Ostrolenk, Faber, Gerb & Soffen, LLP

Related U.S. Application Data

[63] Continuation of Ser. No. 556,769, Nov. 2, 1995, Pat. No. 5,718,805, which is a continuation of Ser. No. 286,948, Aug. 8, 1994, Pat. No. 5,500,091, which is a continuation of Ser. No. 55,918, Apr. 29, 1993, Pat. No. 5,389,206, which is a continuation of Ser. No. 773,965, Nov. 12, 1991, abandoned.

[30] **Foreign Application Priority Data**

Aug. 22, 1989 [DE] Germany 39 27 597.3

[51] **Int. Cl.**⁶ **D21F 1/00**

[52] **U.S. Cl.** **162/203; 162/301**

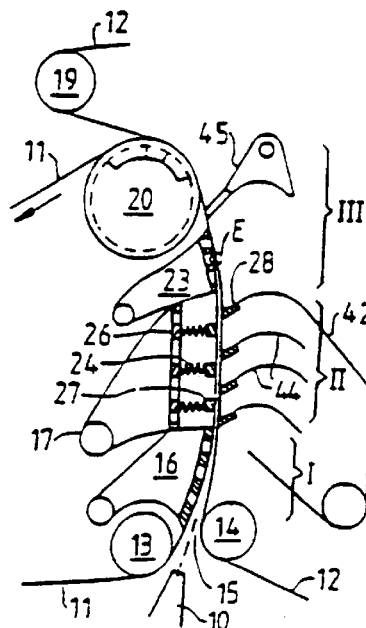
[58] **Field of Search** 162/203, 300, 162/301, 303, 348, 352

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[57] **ABSTRACT**

In a twin-wire former for the production of a paper web, two wire belts (11 and 12) together form a twin-wire zone which is divided into three sections (I, II and III). In the first section (I) the two wires (11, 12) travel over a curved forming shoe (16). They form there a wedge-shaped inlet slot (15) with which a headbox (10) is directly associated. In the second section (II), several resiliently supported strips (27) rest against the lower wire (11) and between each of said strips (27) a rigidly mounted strip (28) rests against the upper wire (12). In the third section (III) both wire belts (11, 12) pass over another curved forming shoe (23).

2 Claims, 2 Drawing Sheets

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Fig.1

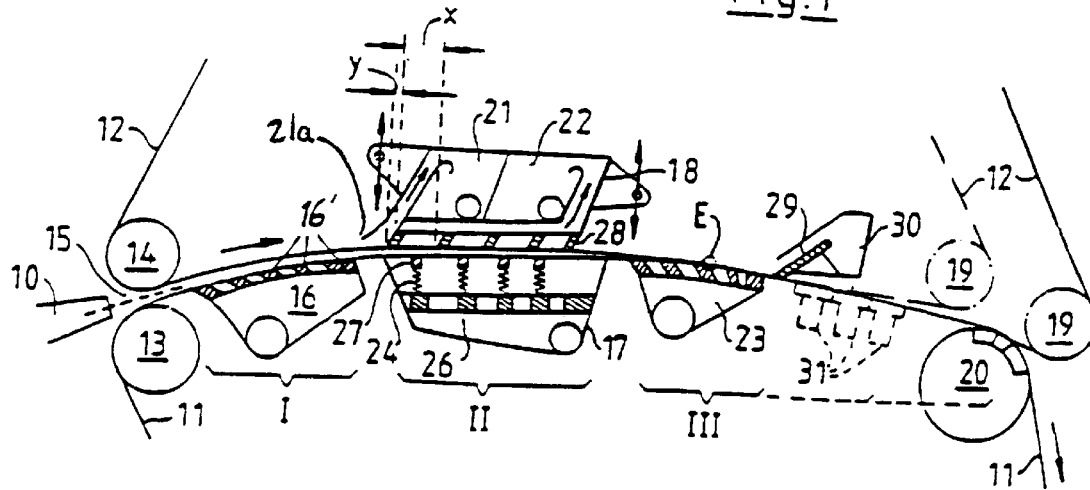


Fig.2

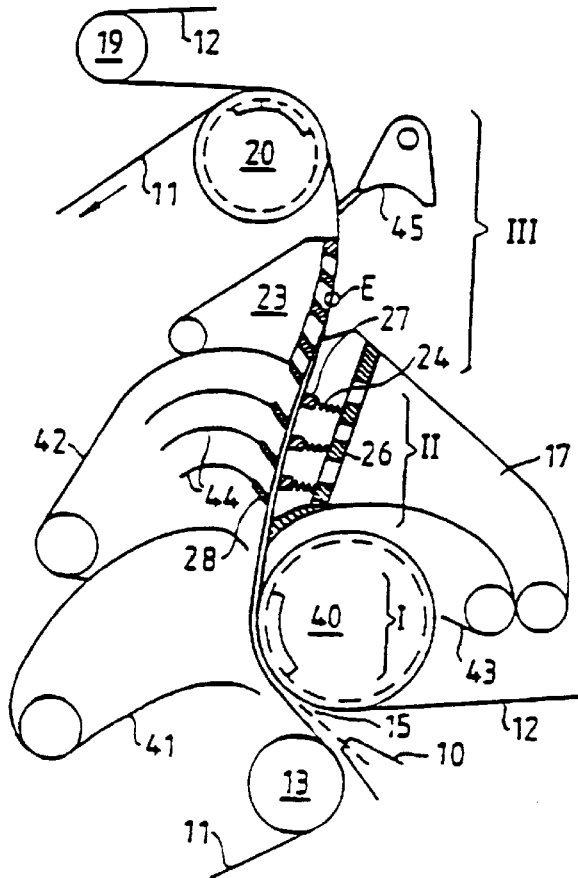
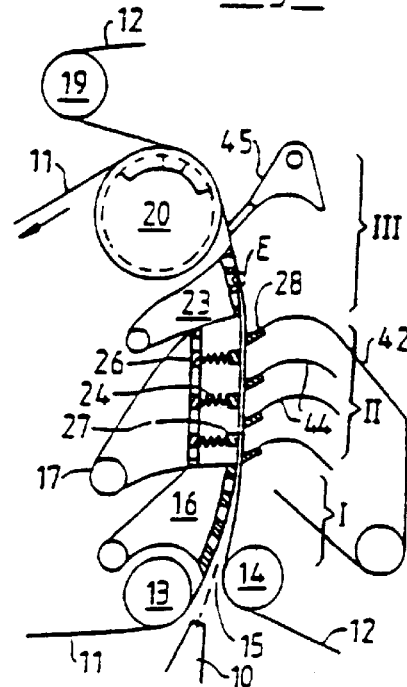


Fig.3

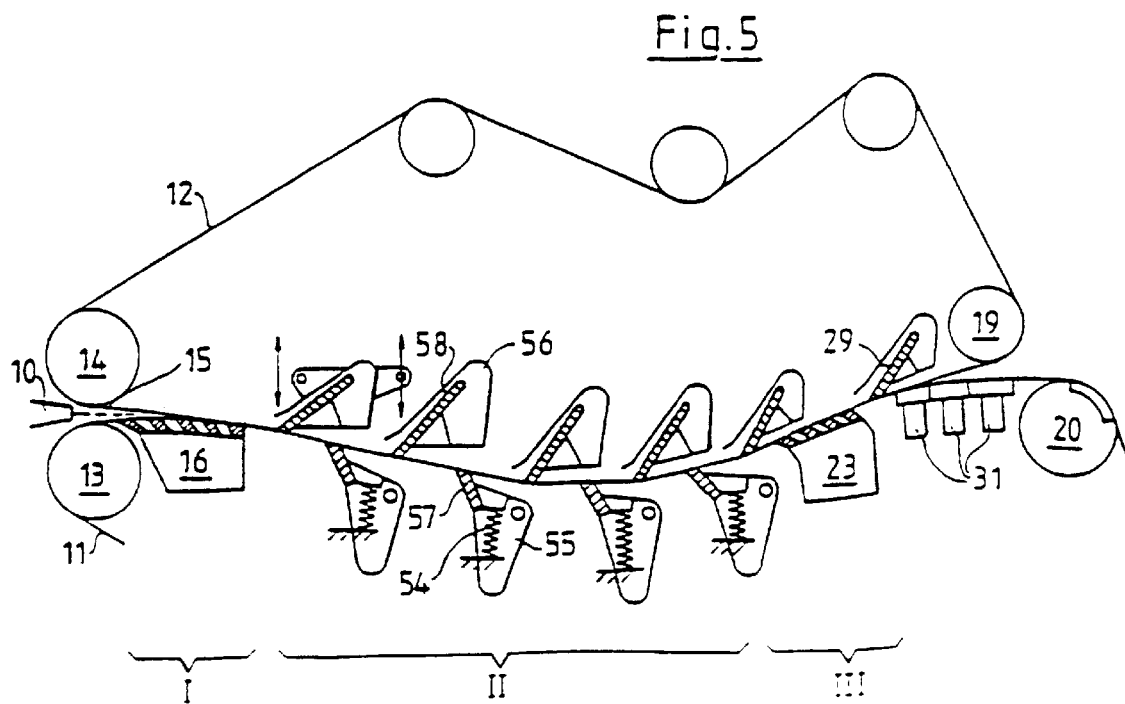
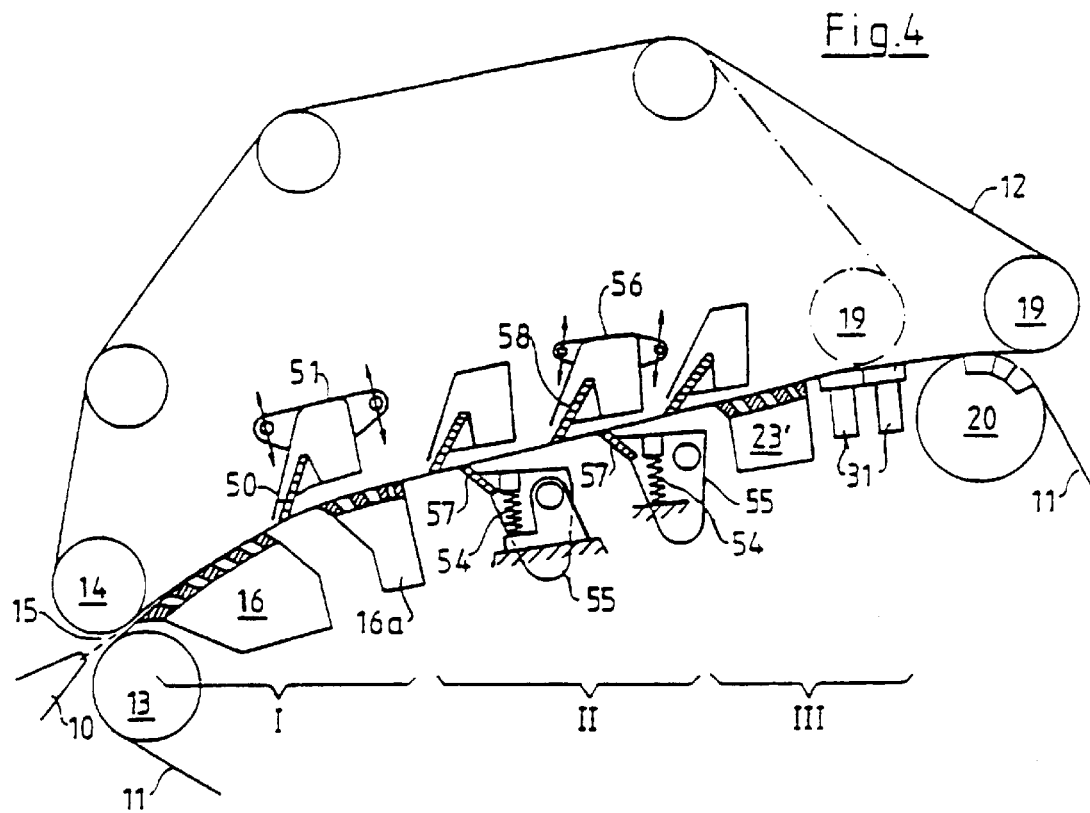


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TWIN WIRE FORMER**RELATED APPLICATIONS**

This is a continuing application of, and hereby incorporates by reference the entire disclosure of, application Ser. No. 08/556,769, filed Nov. 2, 1995 now U.S. Pat. No. 5,718,805, which is a continuing application Ser. No. 08/286,948, filed Aug. 8, 1994 now U.S. Pat. No. 5,500,091, which is a continuing application Ser. No. 08/055,918, filed Apr. 29, 1993, issued Feb. 14, 1995 as U.S. Pat. No. 5,389,206, which is a continuing application Ser. No. 07/773,965, filed Nov. 12, 1991, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to a twin-wire former for the production of a fiber web, in particular a paper web, from a fiber suspension. The invention proceeds from the basis of the twin-wire former known from British Patent 1 125 906. The features indicated in the patent include a twin wire former for producing a fiber web and particularly a paper web from a fiber suspension. Two web forming wire belts, in the form of endless loops, travel together to form a twin wire zone. The web travels between and along the path of the wire belts through the twin wire zone. The twin wire zone has three sections and the elements in those three sections are described below. The patent describes features that state, in other words, that the forming of the fiber web from the pulp suspension fed from the headbox takes place exclusively between two wire belts. Thus, there is no so-called single-wire pre-drainage path. In a first section of the twin-wire zone, the two wire belts together form a wedge-shaped inlet slot; a jet of pulp slurry coming from the headbox discharges into it. The jet strikes the two wire belts at a place where they pass over a curved drainage element; in the case of the aforementioned British patent, this is a stationary, curved forming shoe. Its curved wire guide surface is formed of a plurality of strips with drainage slots between them. This forming shoe is followed (in a second section of the twin-wire zone) by a drainage strip arranged in the other wire loop and, behind the latter, by a drainage strip arranged in the first-mentioned wire loop (and formed by a first suction box). Finally, in a third section of the twin-wire zone there are a plurality of stationary drainage elements developed as flat suction boxes.

It has been attempted for decades with twin-wire formers of the known type to produce fiber webs (in particular, paper webs) of the highest possible quality with relatively high operating speeds. Due to the forming of the web between two wires, the result, in particular, is obtained that the final fiber web has substantially the same properties on both sides (little "two-sidedness"). However, it is difficult to obtain as uniform as possible a distribution of the fibers in the final fiber web. In other words, it is difficult to obtain a good "formation" since while the web is formed, there is always the danger that fibers will agglomerate and form flocculations. Therefore, it is attempted to form a jet of pulp slurry which pulp slurry is as free as possible of flocculations in the headbox (for instance, by means of a turbulence producer). It is, furthermore, endeavored so to influence the drainage of the fiber suspension during the web-forming that "reflocculation" is avoided as far as possible or that, after possible flocculation, a "deflocculation" (i.e. a breaking up of the flocculations) takes place.

It is known that a curved drainage element arranged in the first section of the twin-wire zone and, in particular, a stationary curved forming shoe developed in accordance

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with the aforementioned British Patent 1 125 906 counteracts the danger of reflocculation. This is true also of the drainage strips arranged in the British Patent in the second section of the twin-wire zone. Nevertheless, the danger of reflocculation is not completely eliminated in the arrangement according to said British Patent. Since the number of drainage strips there is very small, a large part of the web-forming takes place in the region of the following flat-suction boxes. They, to be sure, are of high drainage capacity so that the web-forming can be completed in the region of the last flat suction boxes (i.e. the so-called main drainage zone, in which a part of the fiber material is still in the form of a suspension, terminates in the region of the flat suction box). The flat suction boxes, however, are not able to avoid reflocculation or to break up flocculations which have already occurred.

In order to control these last-mentioned difficulties, a web-forming device known under the name of "Duoformer D" has been developed (TAPPI Proceedings 1988 annual meeting, pages 75 to 80). This known web-forming device is part of a twin-wire former which has a single-wire pre-drainage zone. In the twin-wire zone there are provided, in the one wire loop, a plurality of strips which are fixed in position but adjustably supported, namely, on the bottom of a suction box which drains in upward direction. Furthermore, a plurality of resiliently supported strips are provided in the other wire loop. By this resilience of the last-mentioned strips, the following result can be obtained: For example, upon an increase of the amount of suspension entering between the two wire belts, the flexibly supported strips can move away somewhat. In this way, the danger (which is present when only firmly supported strips are used) is eliminated of a backing up taking place in the fiber suspension in front of the strips. Such a backing up could destroy the fiber layers which have been formed up to then on the two wire belts. In other words, with this known web-forming device, a drainage pressure, once established, remains constant due to the resiliently supported strips even upon a change in the amount of suspension fed or upon a change in the drainage behavior of the fiber suspension. Therefore, automatic adaptation of the web-forming device to said changed conditions occurs.

With this known web-forming device, fiber webs of relatively good formation can also be formed. With respect to this, however, the demands have increased considerably recently, so that further improvements are desirable.

SUMMARY OF THE INVENTION

The object of the invention is so to develop a twin-wire of the aforementioned kind that the quality of the fiber web produced is further improved, particularly with respect to its formation (cloudiness), and that the twin-wire former can easily be adapted to different operating conditions (for instance, with regard to quantity and drainage behavior of the fiber suspension).

This object is achieved by the features set forth below. In particular, there is a respective drainage strip above each of the two wire belts in the second section of the twin wire zone, and at least one of the two drainage strips is supported resiliently against the respective wire belt while the other may or may not be resiliently supported, and typically is rigidly supported against the respective wire belt. Preferably, there are at least two of the drainage strips and often more against each of the wire belts. The drainage strips against one belt are offset along the path of the wire belts with respect to the drainage strips against the other belt, providing

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a zig zag or staggered array, and the drainage strips against at least one of the belts are resiliently supported.

The inventors have found that a combination of known features, namely:

- A. Twin-wire former without a single-wire pre-drainage zone or at least without a single-wire pre-drainage zone of any substantial length such as to cause any appreciable pre-drainage
- B. Start of the drainage in the twin-wire zone at a preferably curved drainage element, for instance on a rotating forming cylinder or, even better, on a curved stationary forming shoe
- C. Further drainage in the twin-wire zone between strips which are arranged along a "zig-zag" line, the strips which rest against the one wire belt being resiliently supported,

leads to an extremely high increase in the quality of the finished fiber web, so that it satisfies even the highest requirements. At the same time, the twin-wire former of the invention is insensitive to changes in the amount of suspension fed and to changes in the drainage behavior of the fiber suspension. Experiments have shown that it is possible by the invention to obtain both a high increase in quality with respect to the formation and also good values with regard to the retention of fillers and fines. In contradistinction to this, in the known double-wire formers it is constantly found that there is a strong reduction in the retention upon an improvement in the formation.

It was, furthermore, found in experiments that in the second section of the twin-wire zone the number of strips can be considerably reduced as compared with the "Duo-former D". However, this number is substantially greater than in the case of the twin-wire former known from British Patent 1 125 906. It is advantageous to increase the distance between adjacent strips as compared with the "Duoformer D". In particular, the drainage strips above each one of the wire belts are of a thickness along the path of the wire belts and the spacing between adjacent strips above each wire belt is a minimum of about three times the strip thickness.

To be sure, from German OS 31 38 133, FIG. 3, a twin-wire former is known the twin-wire zone of which is provided in a first section with a curved stationary drainage element and in a second section with strips arranged along a "zig-zag" line, which strips may also be resiliently supported and there being a relatively large distance between them. However, in that case, in front of the twin-wire zone there is a single-wire pre-drainage zone in which the forming of the web starts initially only in a lower layer of the fiber suspension fed while the upper layer remains liquid and tends very strongly to flocculation. It has been found that these flakes cannot be broken up again to the desired extent in the following twin-wire zone. Another disadvantage is that the twin-wire zone is diverted by a guide roll (14b) behind the second section. This results (due to the so-called table-roll effect) in a further drainage which is uneven over the width of the web and thus in undesired variations in the quality of the web (recognizable, for instance, by disturbing longitudinal stripes).

BRIEF DESCRIPTION OF THE DRAWINGS

Other developments of the invention will be explained below with reference to embodiments which are shown in the drawing. Each of FIGS. 1 to 5 shows in simplified diagrammatic form one of the different embodiments.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The twin-wire former shown in FIG. 1 has a substantially horizontally extending twin-wire zone; this zone comprises

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three sections I, II and III arranged one behind the other. The endless wire belts (lower wire 11 and upper wire 12), shown only in part, travel in the direct vicinity of a headbox 10 over, in each case, a breast roll 13 and 14 respectively, so that the two wire belts together form a wedge-shaped entry slot 15 at the start of the twin-wire zone. The jet pulp discharged by the headbox 10 comes into contact with the two wire belts 11 and 12 only at the place where the lower wire 11 in the first section I of the twin-wire zone travels over a stationary curved forming shoe 16. The curved travel surface thereof is formed of several strips 16' with drainage slits present between them. The distance between the two breast rolls 13 and 14 is variable. The forming shoe 16 can be operated with or without vacuum. Additionally, although it is preferable that the forming shoe 16 be curved, a straight forming shoe may also be used in certain situations.

In the second section II of the twin-wire zone, the two wire belts 11 and 12 (with the partially still liquid fiber suspension present between them) travel between a lower drainage box 17 and an upper drainage box 18. In the lower drainage box 17 there are a row of at least two strips 27 (preferably of approximately rectangular cross section) which are pressed from below resiliently against the lower wire 11. For this purpose, they are supported, for instance, on springs 24 (or pneumatic pressure cushions) on a, preferably water-permeable, plate. It is obvious that the force of the springs (or of the pressure prevailing in the pressure cushions) is individually adjustable.

The upper drainage box 18 is suspended on both the front and rear ends on vertically displaceable support elements as indicated diagrammatically by double arrows. On its lower side, there is a row of at least three strips 28 of preferably parallelogram cross section which rest against the upper side of the upper wire 12 and are rigidly attached to the box 18. Above the strips 28, a front vacuum chamber 21 and a rear vacuum chamber 22 are present in the drainage box 18.

Each of the upper strips 28 scrapes off water from the wire 12. Accordingly, the amount of water scraped off decreases in the direction of flow of the wire 12 from strip to strip. The drainage water from each of the strips 28 except the drainage water scraped off by the first strip may be drained away jointly. However, it is disadvantageous to also include the drainage water from the first strip 28 since this generally would disturb the operation of the other strips. Accordingly, a vertical channel 21a is positioned in front of the first upper strip 28 to carry away or collect the water scraped off by the first strip 28.

In the region of the forming shoe 16, a part of the water of the fiber suspension is led off downward; another part penetrates due to the tension of the upper wire 12 upwards through the upper wire and is deflected by the furthest in front of the strips 28 into the front vacuum chamber 21. The water passing upward between the upper strips 28 enters into the rear vacuum chamber 22. The water penetrating between the lower strips 27 through the lower wire 11 is led off downward. Between adjacent upper drainage strips 28 there is a minimum distance X of about three times the thickness Y of the strips. The same is true of the lower resiliently supported strips 27. It is important that each of the strips 27 and 28 lies in the region of a space between two opposite strips so that a "zig-zag" arrangement (i.e. non-opposing relationship) is present. Also, as seen in FIG. 1, the first one of the strips 28 is located upstream of the first one of the strips 27. The two wires 11 and 12 preferably travel on a straight path through section II. Gentle curvature of this section of the path is, however, also possible; see FIGS. 2 and 5. Differing from FIG. 1, the resiliently supported strips

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could also be arranged in the upper box **18** and the firmly supported strips in the lower box **17**. In the third section III of the twin-wire zone, both wire belts **11** and **12** travel over another preferably curved forming shoe **23** which (as shown) is arranged preferably in the lower wire loop **11**. Behind it, an additional strip **29** with vacuum chamber **30** can be arranged in the loop of the upper wire **12**. Furthermore, flat suction boxes **31** can be present in the loop of the lower wire. There (as is shown by dash-dot lines) the upper wire **12** can be separated by means of a guide roll **19** from the lower wire **11** and from the fiber web formed. Lower wire and fiber web then travel over a wire suction roll **20**. The guide roll **19** can, however, also lie further back, so that the upper wire **12** is separated from the lower wire **11** only on the wire suction roll **20**.

It is important that two drainage boxes **17** and **18** with the alternately resiliently and firmly supported ledge strips **27** and **28** lie not in the front or the rear sections but in the middle section II of the twin-wire zone, since only here can they develop their full effect, namely, intensive drainage of the fiber suspension fed while retaining the fine flocculation-free fiber distribution. This is achieved in the manner that the corresponding wire belt is imparted a slight (scarcely visible) deflection on each strip so that turbulence is constantly produced in the still liquid part of the fiber pulp. For success it is, however, also decisive that previously, in section I, a known pre-drainage towards both sides has already taken place and that this also takes place with the greatest possible retention of the flocculation-free condition of the fiber suspension.

For this two-sided pre-drainage, a stationary preferably curved forming shoe is provided in the first section I of the twin-wire zone (in accordance with FIGS. 1 and 3-5) whenever it is a question of satisfying the highest quality demands with respect to the formation. This effect of the forming shoe is due to the fact that at least the one wire belt travels polygonally from strip to strip, each strip not only leading water away but also producing turbulence in the pulp which is still liquid. With such a forming shoe, it is, however, difficult at times to obtain a stable operating condition upon the starting of the paper machine. Therefore, it may be advantageous to provide a known forming roll **40** in accordance with FIG. 2 in Section I instead of the stationary forming shoe and the breast roll lying in front of it. This possibility will be utilized when, in particular, the highest productivity is demanded from the paper manufacturing machine.

In the third section III, the aforementioned strip **29** can serve either solely to lead away water upwards or, in addition, for the further production of turbulence (for further improvement in quality). The latter is possible if a part of the fiber pulp is still in liquid condition at this place.

In FIGS. 1 to 3, the distance between the two wires **11** and **12** in the twin-wire zone has been shown greatly exaggerated. By this, it is intended to make it clear that the two wires **11** and **12** converge towards each other over a relatively long path within the twin-wire zone. This makes it clear that the process of web-forming on the first forming shoe **16** (in Section I) commences relatively slowly and is completed only in Section III. In this connection, the end of the main drainage zone in which the two wires converge towards each other (and thus, the end of the web-forming process) can lie approximately in the center of the wrapping zone of the second forming shoe **23**, as is indicated, merely by way of example, in FIGS. 1 to 3. The end of the wire convergence is symbolically indicated there by the point E; the solids content of the paper web has reached there approximately

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the value of 8%. This point can, however, also lie, for instance, on one of the flat suction boxes **31**. Behind this point, it is attempted further to increase the solids content, if possible before the separation of the two wires. One goal is, namely, for the separation of the wires to take place with the highest possible solids content of the web so that as few fibers as possible are torn out of the web upon the separation. The nature and number of the drainage elements necessary for this within the twin-wire zone may, however, differ greatly and is dependent, among other things, on the type of paper and the raw-material components thereof, as well as on the operating speed.

The embodiments shown in FIGS. 2 and 3 differ from the others primarily by the fact that the twin-wire zone rises substantially vertically upward in the direction of travel of the wires. In this way, the removal of the water withdrawn from the fiber suspension is simplified since the water can be discharged relatively uniformly towards both sides. No vacuum chambers are required in particular in the central section II of the twin-wire zone. To be sure, the forming roll **40** of FIG. 2 is, as a rule, developed as a suction roll. The forming shoes **16**, **23**, particularly those arranged in the third section III, can, if necessary, be provided with a suction device.

Further elements of the twin-wire former shown in FIG. 2 are water-collection containers **41**, **42** and **43**, guide plates **44** associated with the fixed strips **28**, and a water removal strip **45**. The other elements are provided with the same reference numbers as the corresponding elements in FIG. 1. The same is true with regard to FIG. 3. One possible modification of FIG. 3 can consist therein that, instead of the wire suction roll **20**, a forming roll is provided, and instead of the guide roll **19** the wire suction roll. A similar arrangement is known from German Utility Model 88 06 036 (Voith File: P 4539). Aside from this exception and aside from the embodiment according to FIG. 2 (with forming roll **40**), the invention will, however, be used whenever possible-so to design the twin-wire former that the relatively expensive forming roll (as to purchase and operation) can be dispensed with. Thus, as a rule, the wire suction roll **20** is present as the sole suction roll. Furthermore, in all embodiments of the invention it can be seen to it that no guide roll which deflects the twin-wire zone (and has the above-mentioned injurious table-roll effect) is present.

The embodiment of FIG. 4 differs from FIG. 1 among other things by the fact that, in the first section I of the twin-wire zone, a second curved stationary forming shoe **16a** is arranged in the loop of the lower wire **11** behind and spaced from a first curved stationary forming shoe **16**. Furthermore, in the loop of the upper wire **12** in the region between the two stationary forming shoes **16** and **16a** there is provided an individual strip **50** which in known manner is part of a vacuum chamber **51**. This vacuum chamber **51**, similar to the upper drainage box **18** of FIG. 1, is suspended on its front and rear ends in vertically displaceable mounts. In this way, both the depth of penetration of the strip **50** into the path of travel of the upper wire **12** as well as the angle of attack of the strip **50** can be varied. With slight depth of penetration, the strip **50** serves solely for removal of water, while with greater depth of penetration it serves, in addition, for the production of turbulence in the suspension and, thus, for improvement of the formation. By the presence of two separate forming shoes **16** and **16a**, the pre-drainage on both sides is temporarily interrupted; it is only continued after the strip **50** has removed from the upper wire **12** the water which has penetrated upward on the first forming shoe **16**. In this way, higher operating speeds are possible.

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Another difference from FIG. 1 is that, in the second section II of the twin-wire zone, the lower, flexibly supported strips 57 and the upper, firmly supported strips 58 are developed as individual strips. This means that each strip has its own supporting body 55/56. The lower strip-supporting bodies 55 are swingably mounted, the strip 57 being pressed resiliently by the force of springs 54 against the bottom of the lower wire 11. The supporting body 56 of each of the upper strips 58 is developed as vacuum chamber in the same way as that of the strip 50. The suspension of these vacuum chambers 56 corresponds to that of the vacuum chamber 51. It is important that each of the strips 57 and 58 rest with a given force of application (corresponding to the suspension pressure) against its wire belt 11 or 12. The strips 57 and 58 are adjusted in such a manner that a slight deflection of the wire belts takes place preferably on each strip. Due to the resilient supporting of the lower strips 57, the adjustment, once effected, is insensitive to changes in the quantity or quality of pulp, so that no backing up takes place in front of the strips and, nevertheless, an effective introduction of turbulence forces into the fiber suspension takes place. In contradistinction to FIGS. 1 to 3, there is the possibility of adjusting each one of the strips 57/58 individually with respect to position in height and inclination relative to the travel path of the wire. In this way, one can even better control the quality of the paper produced, with respect to both the formation and the nature of its surface (printability). Differing from FIG. 4, the upper strips 58 could be supported resiliently and the lower strips 57 stationary. Another alternative could consist therein that not only the upper strips 58 but also the lower strips 57 are fastened in vertically displaceable mounts (as shown on the vacuum chamber 51). In such case, the springs 54 might possibly be eliminated.

Another difference between FIGS. 1 and 4 resides in the fact that in FIG. 4 the twin-wire zone rises in the direction of travel of the wires upwards with an inclination of, on the average, about 20° with respect to the horizontal. In this way, it is possible to keep the entire height of the twin-wire former relatively slight. In the third section III of the twin-wire zone, a flat forming shoe 23' is provided rather than a curved one, differing from FIG. 1. The separation of the upper wire 12 from the lower wire and the fiber web formed can take place, as in FIG. 1, on one of the flat suction boxes 31. Instead of this, however, the upper wire 12 can also be conducted up to the wire suction roll 20. There, as shown, it can wrap around a small part (or, alternatively, a larger part) of the circumference of the wire suction roll and then be returned via the reversing roll 19.

In the embodiment shown in FIG. 5, the twin-wire zone, as a whole, extends substantially in horizontal direction. The individual elements are substantially the same as in the embodiment of FIG. 4. However, there is the difference that the drainage strips 57 and 58 lying in the second section II of the twin-wire zone are arranged along a downwardly curved path of the twin-wire zone. Accordingly, an upwardly curved forming shoe 16, 23 is provided in the first section I and in the third section III of the twin-wire zone. This embodiment is advisable, in particular, for the modernizing of existing Fourdrinier paper machines.

The embodiments shown have the feature in common that, in the second section II of the twin-wire zone, there are present preferably n flexibly supported strips 27/57 and n+1 rigidly supported strips. However, it is also possible to make the number of flexibly supported strips equal to or greater by one than the number of rigidly supported strips. Instead of a rigidly supported strip, a feed or discharge edge of a drainage box can also be provided. The minimum number n

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of flexibly supported strips is two (see FIG. 4). However, three or four flexibly supported strips are preferred.

What is claimed is:

1. A method for the production of a paper web from a fiber suspension in a twin wire former comprising:

causing first and second web forming wire belts to travel along a path together to form a twin wire zone of the twin wire former, with the web between the wire belts as the wire belts travel along the path through the twin wire zone, each wire belt forming an endless loop;

feeding the wire belts across a single forming roll at the start of the path through the twin wire zone;

supporting the wire belts such as to form a wedge shaped entrance slot into the twin wire zone;

supplying a fiber suspension from a headbox directly to the wedge shaped entrance slot of the twin wire zone;

draining water from the fiber suspension by means of the forming roll in order to form the web from the fiber suspension;

feeding the wire belts with the fiber suspension and the web being generated therebetween downstream of the web being generated therebetween downstream of the forming roll between a plurality of first drainage strips, which are positioned within the loop of the first wire belt for contacting the first wire belt, and a plurality of second drainage strips, which are positioned within the loop of the second wire belt for contacting the second wire belt, the first strips being shifted in position along the path of the wire belts with respect to the second strips so that the first and second strips are offset and in a non-opposing relationship;

resiliently supporting the first drainage strips against the first wire belt that the strips contact;

rigidly supporting the second drainage strips against the second wire belt;

supplying a vacuum in the area of the second drainage strips;

feeding the wire belts with the web therebetween downstream of said drainage strips across a stationary drainage element in the twin wire zone such that as the wire belts travel over the stationary drainage element, water is drained through the wire belt in contact with said stationary drainage element; and

maintaining the twin wire zone apart from said single forming roll free of rolls which would deflect the twin wire zone.

2. A twin-wire former for the production of a paper web from a fiber suspension, the twin wire former comprising:

first and second web forming wire belts which travel along a path together for forming a twin wire zone of the twin wire former, with the web between the wire belts as the wire belts travel along the path through the twin wire zone, neither wire belt defining a single wire predrainage zone;

each wire belt forming an endless loop;

the twin wire zone having a first section which includes a single forming roll at the start of the path of the belts through the twin wire zone; supports which support the wire belts for forming a wedge shaped entrance slot into the first section;

a fiber suspension supplying headbox having an outlet placed and directed for delivering fiber suspension from the headbox to the wedge shaped entrance slot of the first section of the twin wire zone;

said single forming roll having an open surface to enable drainage of water from the fiber suspension and being

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curved along the path of the wire belts through the twin wire zone, the single forming roll being engaged by one of the wire belts and being arranged for curving the path of both wire belts around the single forming roll after the entrance of the suspension into the entrance slot;

the twin wire zone having a second section following the first section along the path of the wire belts through the twin wire zone; in the second section, a plurality of the first drainage strips are positioned within the loop of the first wire belt and are for contacting the first wire belt; in the second section, a plurality of second drainage strips are positioned within the loop of the second wire belt and are for contacting the second wire belt; the first strips being shifted in position along the path of the wire belts with respect to the second strips so that the first and second strips are offset and in a non-opposing relationship; a first strip support which resiliently sup-

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ports the first drainage strips against the first wire belt that the first strips contact;

a second strip support which supports the second drainage strips rigidly against the second wire belt; and a supplier of vacuum in the area of the second drainage strips;

the twin wire zone having a third section following the second section along the path of the wire belts through the twin wire zone; a second drainage element in the third section, for being engaged by one of the wire belts as the wire belts travel over the second drainage element, the second drainage element having an open surface to enable water to be drained through the wire belt in contact therewith; and

the twin wire zone apart from said single forming roll being free of rolls which deflect the twin wire zone.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 5,853,544
DATED : December 29, 1998
INVENTOR(S) : Rudolf Buck

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Column 8, line 18, delete "form" and insert --start the forming--.

Column 10, line 9, delete "second" and insert --stationary--.

Column 10, line 11, delete "second" and insert --stationary--.

Column 10, line 12, delete "second" and insert --stationary--.

Signed and Sealed this
Twenty-third Day of February, 1999

Attest:



Q. TODD DICKINSON

Attesting Officer

Acting Commissioner of Patents and Trademarks

EXHIBIT G

07-769-

JS 44 (Rev. 11/04)

CIVIL COVER SHEET

The JS 44 civil cover sheet and the information contained herein neither replace nor supplement the filing and service of pleadings or other papers as required by law, except as provided by local rules of court. This form, approved by the Judicial Conference of the United States in September 1974, is required for the use of the Clerk of Court for the purpose of initiating the civil docket sheet. (SEE INSTRUCTIONS ON THE REVERSE OF THE FORM.)

I. (a) PLAINTIFFS

Johnson Foils, Inc.

(b) County of Residence of First Listed Plaintiff
(EXCEPT IN U.S. PLAINTIFF CASES)

(c) Attorney's (Firm Name, Address, and Telephone Number) (302) 888-0600
George H. Seitz, III, Esq. (#667)
Seitz, VanOgtrop & Green, P.A.

222 Delaware Avenue, Wilmington, DE

DEFENDANTS

Voith Paper GMBH & Co.

County of Residence of First Listed Defendant
(IN U.S. PLAINTIFF CASES ONLY)

NOTE: IN LAND CONDEMNATION CASES, USE THE LOCATION OF THE LAND INVOLVED.

Attorneys (If Known)

II. BASIS OF JURISDICTION (Place an "X" in One Box Only)

- ☐ 1 U.S. Government Plaintiff
☒ 3 Federal Question (U.S. Government Not a Party)
☐ 2 U.S. Government Defendant
☐ 4 Diversity (Indicate Citizenship of Parties in Item III)

III. CITIZENSHIP OF PRINCIPAL PARTIES (Place an "X" in One Box for Plaintiff and One Box for Defendant)

- (For Diversity Cases Only)
- | | | | | | |
|---|----------------------------|---------------------------------------|---|---------------------------------------|----------------------------|
| Citizen of This State | <input type="checkbox"/> 1 | <input type="checkbox"/> 1 | Incorporated or Principal Place of Business In This State | <input checked="" type="checkbox"/> 4 | <input type="checkbox"/> 4 |
| Citizen of Another State | <input type="checkbox"/> 2 | <input type="checkbox"/> 2 | Incorporated and Principal Place of Business In Another State | <input type="checkbox"/> 5 | <input type="checkbox"/> 5 |
| Citizen or Subject of a Foreign Country | <input type="checkbox"/> 3 | <input checked="" type="checkbox"/> 3 | Foreign Nation | <input type="checkbox"/> 6 | <input type="checkbox"/> 6 |

IV. NATURE OF SUIT (Place an "X" in One Box Only)

CONTRACT	TORTS	FORFEITURE/PENALTY	BANKRUPTCY	OTHER STATUTES	
<input type="checkbox"/> 110 Insurance <input type="checkbox"/> 120 Marine <input type="checkbox"/> 130 Miller Act <input type="checkbox"/> 140 Negotiable Instrument <input type="checkbox"/> 150 Recovery of Overpayment & Enforcement of Judgment <input type="checkbox"/> 151 Medicare Act <input type="checkbox"/> 152 Recovery of Defaulted Student Loans (Excl. Veterans) <input type="checkbox"/> 153 Recovery of Overpayment of Veteran's Benefits <input type="checkbox"/> 160 Stockholders' Suits <input type="checkbox"/> 190 Other Contract <input type="checkbox"/> 195 Contract Product Liability <input type="checkbox"/> 196 Franchise	PERSONAL INJURY <input type="checkbox"/> 310 Airplane <input type="checkbox"/> 315 Airplane Product Liability <input type="checkbox"/> 320 Assault, Libel & Slander <input type="checkbox"/> 330 Federal Employers' Liability <input type="checkbox"/> 340 Marine <input type="checkbox"/> 345 Marine Product Liability <input type="checkbox"/> 350 Motor Vehicle <input type="checkbox"/> 355 Motor Vehicle Product Liability <input type="checkbox"/> 360 Other Personal Injury	PERSONAL INJURY <input type="checkbox"/> 362 Personal Injury - Med. Malpractice <input type="checkbox"/> 365 Personal Injury - Product Liability <input type="checkbox"/> 368 Asbestos Personal Injury Product Liability PERSONAL PROPERTY <input type="checkbox"/> 370 Other Fraud <input type="checkbox"/> 371 Truth in Lending <input type="checkbox"/> 380 Other Personal Property Damage <input type="checkbox"/> 385 Property Damage Product Liability	<input type="checkbox"/> 610 Agriculture <input type="checkbox"/> 620 Other Food & Drug <input type="checkbox"/> 625 Drug Related Seizure of Property 21 USC 881 <input type="checkbox"/> 630 Liquor Laws <input type="checkbox"/> 640 R.R. & Truck <input type="checkbox"/> 650 Airline Regs. <input type="checkbox"/> 660 Occupational Safety/Health <input type="checkbox"/> 690 Other	<input type="checkbox"/> 422 Appeal 28 USC 158 <input type="checkbox"/> 423 Withdrawal 28 USC 157 PROPERTY RIGHTS <input type="checkbox"/> 820 Copyrights <input type="checkbox"/> 830 Patent <input type="checkbox"/> 840 Trademark SOCIAL SECURITY <input type="checkbox"/> 861 HIA (1395ff) <input type="checkbox"/> 862 Black Lung (923) <input type="checkbox"/> 863 DIWC/DIWW (405(g)) <input type="checkbox"/> 864 SSID Title XVI <input type="checkbox"/> 865 RSI (405(g)) FEDERAL TAX SUITS <input type="checkbox"/> 870 Taxes (U.S. Plaintiff or Defendant) <input type="checkbox"/> 871 IRS—Third Party 26 USC 7609	<input type="checkbox"/> 400 State Reapportionment <input type="checkbox"/> 410 Antitrust <input type="checkbox"/> 430 Banks and Banking <input type="checkbox"/> 450 Commerce <input type="checkbox"/> 460 Deportation <input type="checkbox"/> 470 Racketeer Influenced and Corrupt Organizations <input type="checkbox"/> 480 Consumer Credit <input type="checkbox"/> 490 Cable/Sat TV <input type="checkbox"/> 810 Selective Service <input type="checkbox"/> 850 Securities/Commodities/Exchange <input type="checkbox"/> 875 Customer Challenge 12 USC 3410 <input checked="" type="checkbox"/> 890 Other Statutory Actions <input type="checkbox"/> 891 Agricultural Acts <input type="checkbox"/> 892 Economic Stabilization Act <input type="checkbox"/> 893 Environmental Matters <input type="checkbox"/> 894 Energy Allocation Act <input type="checkbox"/> 895 Freedom of Information Act <input type="checkbox"/> 900 Appeal of Fee Determination Under Equal Access to Justice <input type="checkbox"/> 950 Constitutionality of State Statutes

V. ORIGIN

(Place an "X" in One Box Only)

- ☒ 1 Original Proceeding
☐ 2 Removed from State Court
☐ 3 Remanded from Appellate Court
☐ 4 Reinstated or Reopened
☐ 5 Transferred from another district (specify)
☐ 6 Multidistrict Litigation
☐ 7 Appeal to District Judge from Magistrate Judgment

Cite the U.S. Civil Statute under which you are filing (Do not cite jurisdictional statutes unless diversity):

VI. CAUSE OF ACTION

Brief description of cause:

Declaratory Judgment, 28 U.S.C., Section 2201, et seq. and 35

VII. REQUESTED IN COMPLAINT:

☐ CHECK IF THIS IS A CLASS ACTION UNDER F.R.C.P. 23
 DEMAND \$
 CHECK YES only if demanded in complaint: JURY DEMAND: ☒ Yes ☐ No

VIII. RELATED CASE(S) IF ANY

(See instructions):

JUDGE Joseph J. Farnan

DOCKET NUMBER 07-226 JJF 1, et sec

DATE 11/27/07

SIGNATURE OF ATTORNEY OF RECORD

FOR OFFICE USE ONLY

George H. Seitz, III, Esquire (#667)

RECEIPT # AMOUNT APPLYING IFP JUDGE MAG. JUDGE

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

JOHNSONFOILS, INC.,
A Delaware Corporation,

Plaintiff,

C.A. No. _____

V.

JURY TRIAL DEMANDED

VOITH PAPER
GMBH & CO. KG,
A Company organized and existing
under the laws of Germany,

Defendant.

COMPLAINT

1. Plaintiff JohnsonFoils ("JohnsonFoils"), is a corporation organized and existing under the laws of the State of Delaware, with its principal place of business located at 40 Progress Avenue, Springfield, MA 01104.

2. Upon information and belief, Defendant, Voith Paper GmbH & Co. KG's ("Voith"), is a corporation organized and existing under the laws of Germany, with its principal place of business at Sankt Poeltener Strasse 43, Heidenheim, Germany 89522.

VENUE AND PERSONAL JURISDICTION

3. Jurisdiction arises under 28 U.S.C. §§ 1331, 1338, 1367, 2201 and 2202.

4. Venue is proper in this District under 28 U.S.C. §§ 1391 and 1400.

BACKGROUND

5. JohnsonFoils is in the business of researching, designing and developing drainage equipment, cleaning systems, ceramic products and technology for the management of water removal and sheet formation on pulp and paper machines.

6. U.S. Patent No. 5,389,206 ("the '206 Patent") issued on February 14, 1995, for a "TWIN WIRE FORMER". A copy of the '206 Patent is attached as Exhibit "A" to this Complaint.

7. U.S. Patent No. 5,500,091 ("the '091 Patent") issued on March 19, 1996, for a "TWIN WIRE FORMER". A copy of the '091 Patent is attached as Exhibit "B" to this Complaint.

8. U.S. Patent No. 5,853,544 ("the '544 Patent") issued on December 29, 1998 for a "TWIN WIRE FORMER". A copy of the '544 Patent is attached as Exhibit "C" to this Complaint.

9. U.S. Patent No. 5,718,805 ("the '805 Patent") issued on February 17, 1998 for a "TWIN WIRE FORMER". A copy of the '805 Patent is attached as Exhibit "D" to this Complaint.

10. U.S. Patent No. 5,972,168 ("the '168 Patent") issued on December 29, 1998 for a "TWIN WIRE FORMER". A copy of the '168 Patent is attached as Exhibit "E" to this Complaint.

11. Upon information and belief, the assignment records of the United States Patent and Trademark Office ("PTO") reflect ownership of the '805 Patent, the '168 Patent, the '206 Patent, the '091 Patent, and the '544 Patent (collectively referred to as "Voith's Twin Wire Former Patents") in the name of Voith.

12. All of Voith's Twin Wire Former Patents are a family of related patents with the same subject matter and same specification that claim priority to application Serial No. 07/773,965, filed as PCT/EP90/01313, which is now abandoned.

13. On April 27, 2007, Voith filed a Complaint, in the United States District Court for the District of Delaware and docketed as C.A. No. 07-02226-JJF, alleging that JohnsonFoils infringed the '805 and '168 Patents.

14. On August 24, 2007, JohnsonFoils filed requests for reexamination with the PTO for the '805 and '168 Patents.

15. On November 16, 2007 JohnsonFoils filed requests for reexamination with the PTO for the '206; '091; and, '544 Patents.

16. Voith asserts that the JohnsonFoils twin wire former products that utilize resiliently mounted blades infringe Voith's Twin Wire Former Patents and is an "Accused Product." A copy Plaintiff's [Voith] First Set of Interrogatories to JohnsonFoils, Inc. is attached as Exhibit "F" to this Complaint; see the definition of "Accused Product" on page 5.

17. There is a substantial and continuing justiciable controversy between Voith and JohnsonFoils regard JohnsonFoils' right to manufacture and sell twin

wire formers having resiliently mounted blades and its infringement of the '206; '091; or '544 Patents.

Count I
Declaratory Judgment of Non-Infringement of the '206 Patent

18. JohnsonFoils incorporates Paragraphs 1-17 by reference as though fully set forth herein.

19. An actual controversy requiring a declaration of rights by this Court exists under the Patent Act between JohnsonFoils and Voith concerning the alleged infringement.

20. JohnsonFoils' declaratory relief is brought pursuant to the Declaratory Judgment Act, 28 U.S.C. §§ 2201, *et seq.* and 35 U.S.C. §§ 1, *et seq.*

21. JohnsonFoils has not and does not infringe, literally or under the doctrine of equivalents, any claim of the '206 Patent.

22. JohnsonFoils has not induced and is not inducing infringement of any claim of the '206 Patent.

23. JohnsonFoils has not in the past and is not now contributing to the infringement of any claim of the '206 Patent.

24. JohnsonFoils is entitled to a declaratory judgment that it has not in the past infringed and is not now infringing any claim of the '206 Patent.

Count II
Declaratory Judgment of Non-Infringement of the '091 Patent

25. JohnsonFoils incorporates Paragraphs 1-24 by reference as though fully set forth herein.

26. An actual controversy requiring a declaration of rights by this Court exists under the Patent Act between JohnsonFoils and Voith concerning the alleged infringement.

27. JohnsonFoils' declaratory relief is brought pursuant to the Declaratory Judgment Act, 28 U.S.C. §§ 2201, *et seq.* and 35 U.S.C. §§ 1, *et seq.*

28. JohnsonFoils has not and does not infringe, literally or under the doctrine of equivalents, any claim of the '091 Patent.

29. JohnsonFoils has not induced and is not inducing infringement of any claim of the '091 Patent.

30. JohnsonFoils has not in the past and is not now contributing to the infringement of any claim of the '091 Patent.

31. JohnsonFoils is entitled to a declaratory judgment that it has not in the past infringed and is not now infringing any claim of the '091 Patent.

Count III
Declaratory Judgment of Non-Infringement of the '544 Patent

32. JohnsonFoils incorporates Paragraphs 1-31 by reference as though fully set forth herein.

33. An actual controversy requiring a declaration of rights by this Court exists under the Patent Act between JohnsonFoils and Voith concerning the alleged infringement.

34. JohnsonFoils' declaratory relief is brought pursuant to the Declaratory Judgment Act, 28 U.S.C. §§ 2201, *et seq.* and 35 U.S.C. §§ 1, *et seq.*

35. JohnsonFoils has not and does not infringe, literally or under the doctrine of equivalents, any claim of the '544 Patent.

36. JohnsonFoils has not induced and is not inducing infringement of any claim of the '544 Patent.

37. JohnsonFoils has not in the past and is not now contributing to the infringement of any claim of the '544 Patent.

38. JohnsonFoils is entitled to a declaratory judgment that it has not in the past infringed and is not now infringing any claim of the '544 Patent.

RELIEF

WHEREFORE, JohnsonFoils requests that this Court enter a judgment:

(a) declaring that JohnsonFoils its suppliers, customers and distributors are not infringing any claim of U.S. Patent Nos., 5,538,206, 5,500,091, and 5,853,544, and upon such finding;

(b) ordering that Voith and all persons in active concert or participation with it are enjoined from alleging, threatening or charging JohnsonFoils, its suppliers, customers or distributors with infringement of U.S. Patent Nos. 5,538,206, 5,500,091, and 5,853,544;

(c) finding this is an exceptional case entitling JohnsonFoils to an award of its attorneys' fees and costs pursuant to 35 U.S.C. § 285; and

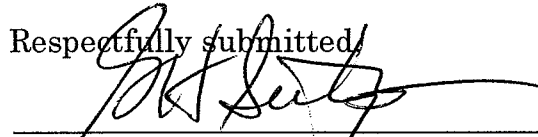
(d) ordering such other and further relief as this Court may deem appropriate.

JURY TRIAL DEMAND

A trial by jury is demanded.

Dated: 11/27/2007

Respectfully submitted,



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222 Delaware Avenue, Suite 1500
P.O. Box 68
Wilmington, DE 19899
(302) 888-7602

Anthony S. Volpe
John O'Malley
Randolph J. Huis
Ryan W. O'Donnell
Volpe and Koenig, P.C.
United Plaza, Suite 1600
30 South 17th Street
Philadelphia, PA 19103
(215) 568-6400

*Attorneys for Defendant
JohnsonFoils, Inc.*

EXHIBIT H

Tony Volpe

From: MICHAEL FINK [MFINK@gbpatent.com]
Sent: Monday, December 03, 2007 11:01 AM
To: George H Seitz III; Poff, Adam; Stover, Chad
Cc: NEAL GOLDBERG; Ryan O'Donnell; Patricia P McGonigle; Tony Volpe
Subject: RE: Johnson Foils vs. Voith, C.A. No. 07-779-

George,

We are not authorized to accept service of the recently filed complaint for declaratory judgment. Please serve Voith in accordance with the Hague Convention.

Best regards,
Michael

Michael J. Fink, Esq.
Greenblum & Bernstein, P.L.C.
1950 Roland Clarke Place
Reston, Virginia 20191
Voice: (703) 716-1191
Facsimile: (703) 716-1180
email: mfink@gbpatent.com
<http://www.gbpatent.com/>

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In rare cases, our spam scanners may eliminate legitimate email. Please advise us immediately if you receive an error notification from our server.

From: George H Seitz III [mailto:gseitz@svglaw.com]
Sent: Wednesday, November 28, 2007 11:33 AM
To: Poff, Adam; Stover, Chad
Cc: MICHAEL FINK; NEAL GOLDBERG; Ryan O'Donnell; Patricia P McGonigle; Tony Volpe
Subject: Johnson Foils vs. Voith, C.A. No. 07-779-

12/21/2007

This will follow up my calls to Adam yesterday. Attached is a copy of the complaint just filed
Will you agree to accept service?

Also will you agree to consolidate it with C. A. No. 07-226-JJF?

George H Seitz III, Esq.

302-888-7602

302-888-0606 (Fax)

gseitz@svglaw.com

12/21/2007

EXHIBIT I



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Philadelphia, PA 19103

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Facsimile: +1-215-568-6499
www.volpe-koenig.com

BRINGING LAW TO YOUR IDEAS

December 17, 2007

Anthony S. Volpe
avolpe@volpe-koenig.com

Michael J. Fink, Esquire
Greenblum & Bernstein, P.L.C.
1950 Roland Clarke Place
Reston, VA 20191

VIA E-MAIL

Re: *Voith Paper GMBH & Co. KG v. JohnsonFoils, Inc.*
Civil Action No. 07-226
and
JohnsonFoils, Inc. v. Voith Paper GMBH & Co. KG v.
Civil Action No. 07-769

Dear Michael:

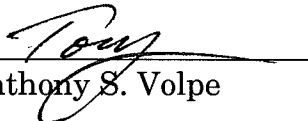
As you know, Voith has refused our request to waive service of the recently filed Complaint for Declaratory Judgment (C.A. No. 07-769). Since this case was assigned to Judge Farnan and the subject matter in the cases are related, we are asking for your consent to our request to amend JohnsonFoils Counterclaims (C.A. No. 07-226). A draft Amended Counterclaim is enclosed for your review.

Since the deadline for amending pleadings is December 20, 2007, please let us have your answer by the close of business on December 19th. In the absence of your agreement, we will file a motion to amend.

If you would like to discuss this matter, we are available for discussions tomorrow or Wednesday.

Very truly yours,

Volpe and Koenig, P.C.

By: 
Anthony S. Volpe

ASV/cps
Enclosure

cc: All counsel of record via e-mail

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

VOITH PAPER GMBH & CO. KG,	:	
	:	
	:	
Plaintiff,	:	
	:	C.A. No. 07-226-UNA
v.	:	
	:	
JOHNSONFOILS, INC.,	:	
	:	
Defendant.	:	

**DEFENDANT, JOHNSONFOILS, INC.'S, ANSWER, AFFIRMATIVE
DEFENSES, AND AMENDED COUNTERCLAIMS TO PLAINTIFF,
VOITH PAPER GMBH & CO. KG'S, COMPLAINT**

Defendant, JohnsonFoils, Inc. ("JohnsonFoils"), by and through its undersigned counsel, hereby responds to the allegations in Plaintiff, Voith Paper GmbH & Co. KG's ("Voith"), Complaint as follows, and asserts the following Affirmative Defenses and Counterclaims.

1. Denied.
2. JohnsonFoils is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph and denies the same.
3. Admitted.
4. Denied.
5. Denied.
6. Denied.
7. Denied as a conclusion of law; however, it is admitted that JohnsonFoils is a Delaware corporation.

8. Denied.
9. Denied as conclusions of law to which no responsive pleading is required.
10. Denied as conclusions of law to which no responsive pleading is required.
11. Denied as conclusions of law to which no responsive pleading is required.
12. Denied as conclusions of law to which no responsive pleading is required.
13. Denied as conclusions of law to which no responsive pleading is required.
14. Denied as stated. It is admitted that formation is a part of the paper making process.
15. JohnsonFoils is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph and denies the same.
16. JohnsonFoils is without knowledge or information sufficient to form a belief as to the truth of the allegations of this paragraph and denies the same.
17. Denied as conclusions of law to which no responsive pleading is required.
18. To the extent the paragraph is understood, it is denied; however, it is admitted that JohnsonFoils is engaged in designing and building improved drainage devices.

19. Denied.

20. Denied.

21. Paragraph 21 of Voith's Complaint is a transitional paragraph to which no response is required.

22. Denied.

23. Denied.

24. Denied.

25. Denied.

26. Denied.

JohnsonFoils further denies that Voith is entitled to any of the relief requested in its Prayer for Relief.

AFFIRMATIVE DEFENSES

First Affirmative Defense

Voith fails to state a claim upon which relief can be granted.

Second Affirmative Defense

JohnsonFoils has not infringed any claim of the Patents-in-Suit, either literally or under the doctrine of equivalents.

Third Affirmative Defense

Each of the Patents-in-Suit is invalid, unenforceable, and void for failure to comply with the provisions of 35 U.S.C. § 101 *et seq.*

Fourth Affirmative Defense

Voith is barred by the doctrine of Prosecution History Estoppel from presenting a claim interpretation necessary to find infringement of any claim of the Patents-in-Suit.

Fifth Affirmative Defense

Voith has misused each of the Patents-in-Suit which renders each of them unenforceable, and Voith is precluded from obtaining any relief in this action due to its misuse.

Sixth Affirmative Defense

Voith's claims are barred, in whole or in part, by the doctrine of equitable estoppel.

Seventh Affirmative Defense

Voith's claims are barred, in whole or in part, by the doctrine of waiver.

Eighth Affirmative Defense

Voith's claims are barred, in whole or in part, by the statute of limitations.

Ninth Affirmative Defense

Voith's claims are barred, in whole or in part, by the doctrine of laches.

COUNTERCLAIMS

Defendant and Counterclaimant, JohnsonFoils, Inc. ("JohnsonFoils"), hereby asserts the following counterclaims against Voith:

Parties

1. Upon information and belief, Plaintiff and Counterclaim Defendant, Voith Paper GmbH & Co. KG's ("Voith"), is a corporation organized and existing under the laws of Germany, with its principal place of business at Sankt Poeltener Strasse 43, Heidenheim, Germany 89522.

2. Defendant and Counterclaimant, JohnsonFoils, is a corporation organized and existing under the laws of the State of Delaware.

3. Defendant and Counterclaimant, JohnsonFoils has its principal place of business located at 40 Progress Avenue, Springfield, MA 01104.

Jurisdiction and Venue

4. Voith has invoked the jurisdiction and venue of this Court by filing its Complaint arising out of the same subject matter as JohnsonFoils' counterclaims.

5. Jurisdiction arises under 28 U.S.C. §§ 1331, 1338, 1367, 2201 and 2202.

6. Venue is proper in this District under 28 U.S.C. §§ 1391 and 1400.

Background

7. JohnsonFoils is in the business of researching, designing and developing drainage equipment, cleaning systems, ceramic products and technology for the management of water removal and sheet formation on pulp and paper machines.

8. U.S. Patent No. 5,389,206 ("206 Patent") issued on February 14, 1995, for a "TWIN WIRE FORMER". A copy of the '206 Patent is attached as Exhibit "A."

9. U.S. Patent No. 5,500,091 ("091 Patent") issued on March 19, 1996, for a "TWIN WIRE FORMER". A copy of the '091 Patent is attached as Exhibit "B."

10. U.S. Patent No. 5,853,544 ("544 Patent") issued on December 29, 1998 for a "TWIN WIRE FORMER". A copy of the '544 Patent is attached as Exhibit "C."

11. U.S. Patent No. 5,718,805 ("805 Patent") issued on February 17, 1998 for a "TWIN WIRE FORMER". A copy of the '805 Patent is attached as Exhibit "D."

12. U.S. Patent No. 5,972,168 ("168 Patent") issued on December 29, 1998 for a "TWIN WIRE FORMER". A copy of the '168 Patent is attached as Exhibit "E."

13. Upon information and belief, the assignment records of the United States Patent and Trademark Office ("PTO") reflect ownership of the '805 Patent, the '168 Patent, the '206 Patent, the '091 Patent, and the '544 Patent (collectively referred to as "Voith's Twin Wire Former Patents") in the name of Voith.

14. The Voith's Twin Wire Former Patents are a single family of related patents that share a common detailed description of the preferred embodiments and the same claim of priority to application Serial No. 07/773,965, filed as PCT/EP90/01313, which is now abandoned.

15. 8.— On April 27, 2007, Voith filed a Complaint in the United States District Court for the District of Delaware, C.A. No. 07-02226-JJF, alleging that JohnsonFoils infringed the '805 and '168 Patents-in-Suit. ("Patents-in-Suit").

~~9. U.S. Patent Nos. 5,718,805 ('805 Patent) and 5,972,168 ('168 Patent),~~
~~(collectively hereinafter the "Patents in Suit") were attached as Exhibits "1" and "2"~~
~~to Voith's Complaint.~~

16. On August 24, 2007, JohnsonFoils filed requests for reexamination
with the PTO for the Patents-in-Suit.

17. On November 16, 2007 JohnsonFoils filed requests for reexamination
with the PTO for the '206; '091; and, '544 Patents.

18. Voith asserts that any JohnsonFoils twin wire former product that
utilizes a resiliently mounted blade is an "Accused Product" (see the definition of
"Accused Product," on page 5 of Plaintiff's [Voith] First Set of Interrogatories to
JohnsonFoils, Inc., Exhibit "F" to this Complaint) and it infringes Voith's Twin Wire
Former Patents.

19. There is a substantial and continuing justiciable controversy between
Voith and JohnsonFoils regard JohnsonFoils' right to manufacture and sell twin
wire formers having a resiliently mounted blade in view of Voith's Twin Wire
Former Patents.

First Counterclaim
Declaratory Judgment of Non-Infringement of the Patents-in-Suit

20. ~~10.~~ The allegations in Paragraphs 1-19 of JohnsonFoils' Counterclaims
are incorporated by reference as though fully set forth herein.

21. ~~11.~~ An actual controversy requiring a declaration of rights by this
Court exists under the Patent Act between JohnsonFoils and Voith concerning the
alleged infringement and the invalidity of the Patents-in-Suit.

22. ~~12.~~—JohnsonFoils' counterclaim for declaratory relief is brought pursuant to the Declaratory Judgment Act, 28 U.S.C. §§ 2201, *et seq.* and 35 U.S.C. §§ 1, *et seq.*

23. ~~13.~~—JohnsonFoils has not and does not infringe, literally or under the doctrine of equivalents, any claim of the Patents-in-Suit.

24. ~~14.~~—JohnsonFoils has not induced and is not inducing infringement of any claim of the Patents-in-Suit.

25. ~~15.~~—JohnsonFoils' has not in the past and is not now contributing to the infringement of any claim of the Patents-in-Suit.

26. ~~16.~~—JohnsonFoils is entitled to a declaratory judgment that it has not in the past infringed and is not now infringing any claim of the Patents-in-Suit.

Second Counterclaim
Declaratory Judgment that the Patents-in-Suit Are Invalid

27. ~~17.~~—The allegations in Paragraphs 1-16 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

28. ~~18.~~—All claims of the Patents-in-Suit are invalid under 35 U.S.C. § 102.

29. ~~19.~~—All claims of the Patents-in-Suit are invalid under 35 U.S.C. § 103.

30. ~~20.~~—All claims of the Patents-in-Suit are invalid under 35 U.S.C. § 112.

31. ~~21.~~—JohnsonFoils is entitled to a declaratory judgment that the all claims of the Patents-in-Suit are invalid, unenforceable, and void pursuant to 35 U.S.C. §§ 101 *et seq.*

Third Counterclaim
Declaratory Judgment of Non-Infringement of the '206 Patent

32. The allegations in Paragraphs 1-19 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

33. An actual controversy requiring a declaration of rights by this Court exists under the Patent Act between JohnsonFoils and Voith concerning the alleged infringement and the invalidity of the '206 Patent.

34. JohnsonFoils' counterclaim for declaratory relief is brought pursuant to the Declaratory Judgment Act, 28 U.S.C. §§ 2201, *et seq.* and 35 U.S.C. §§ 1, *et seq.*

35. JohnsonFoils has not and does not infringe, literally or under the doctrine of equivalents, any claim of the '206 Patent.

36. JohnsonFoils has not induced and is not inducing infringement of any claim of the '206 Patent.

37. JohnsonFoils' has not in the past and is not now contributing to the infringement of any claim of the '206 Patent.

38. JohnsonFoils is entitled to a declaratory judgment that it has not in the past infringed and is not now infringing any claim of the '206 Patent.

Fourth Counterclaim
Declaratory Judgment of Non-Infringement of the '091 Patent

39. The allegations in Paragraphs 1-26 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

40. An actual controversy requiring a declaration of rights by this Court exists under the Patent Act between JohnsonFoils and Voith concerning the alleged infringement and the invalidity of the '091 Patent.

41. JohnsonFoils' counterclaim for declaratory relief is brought pursuant to the Declaratory Judgment Act, 28 U.S.C. §§ 2201, et seq. and 35 U.S.C. §§ 1, et seq.

42. JohnsonFoils has not and does not infringe, literally or under the doctrine of equivalents, any claim of the '091 Patent.

43. JohnsonFoils has not induced and is not inducing infringement of any claim of the '091 Patent.

44. JohnsonFoils' has not in the past and is not now contributing to the infringement of any claim of the '091 Patent.

45. JohnsonFoils is entitled to a declaratory judgment that it has not in the past infringed and is not now infringing any claim of the '091 Patent.

Fifth Counterclaim
Declaratory Judgment of Non-Infringement of the '544 Patent

46. The allegations in Paragraphs 1-33 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

47. An actual controversy requiring a declaration of rights by this Court exists under the Patent Act between JohnsonFoils and Voith concerning the alleged infringement and the invalidity of the '544 Patent.

48. JohnsonFoils' counterclaim for declaratory relief is brought pursuant to the Declaratory Judgment Act, 28 U.S.C. §§ 2201, et seq. and 35 U.S.C. §§ 1, et seq.

49. JohnsonFoils has not and does not infringe, literally or under the doctrine of equivalents, any claim of the '544 Patent.

50. JohnsonFoils has not induced and is not inducing infringement of any claim of the '544 Patent.

51. JohnsonFoils' has not in the past and is not now contributing to the infringement of any claim of the '544 Patent.

52. JohnsonFoils is entitled to a declaratory judgment that it has not in the past infringed and is not now infringing any claim of the '544 Patent.

Sixth Counterclaim
Declaratory Judgment that the '206 Patent Is Invalid

53. The allegations in Paragraphs 1-54 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

54. All claims of the '206 Patent is invalid under 35 U.S.C. § 102.

55. All claims of the '206 Patent is invalid under 35 U.S.C. § 103.

56. All claims of the '206 Patent is invalid under 35 U.S.C. § 112.

57. JohnsonFoils is entitled to a declaratory judgment that the all claims of the '206 Patent is invalid, unenforceable, and void pursuant to 35 U.S.C. §§ 101 et seq.

Seventh Counterclaim
Declaratory Judgment that the '091 Patent Is Invalid

58. The allegations in Paragraphs 1-59 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

59. All claims of the '091 Patent is invalid under 35 U.S.C. § 102.

60. All claims of the '091 Patent is invalid under 35 U.S.C. § 103.

61. All claims of the '091 Patent is invalid under 35 U.S.C. § 112.

62. JohnsonFoils is entitled to a declaratory judgment that the all claims of the '091 Patent is invalid, unenforceable, and void pursuant to 35 U.S.C. §§ 101 et seq.

Eighth Counterclaim
Declaratory Judgment that the '544 Patent Is Invalid

63. The allegations in Paragraphs 1-64 of JohnsonFoils' Counterclaims are incorporated by reference as though fully set forth herein.

64. All claims of the '544 Patent is invalid under 35 U.S.C. § 102.

65. All claims of the '544 Patent is invalid under 35 U.S.C. § 103.

66. All claims of the '544 Patent is invalid under 35 U.S.C. § 112.

67. JohnsonFoils is entitled to a declaratory judgment that the all claims of the '544 Patent is invalid, unenforceable, and void pursuant to 35 U.S.C. §§ 101 et seq.

Ninth Counterclaim
Patent Misuse

68. ~~22.~~ Johnson Foils incorporates paragraphs 1-~~21~~ 67 of its Counterclaims as if fully set forth herein.

69. ~~23.~~ On information and belief, Voith has misused the Patents-in-Suit by filing the present action against Johnson Foils for patent infringement when Voith knew or should have known that Johnson Foils was not infringing any permissible, reasonable or valid interpretation of any claim of the Patents-in-Suit.

70. ~~24.~~ On information and belief, Voith's impermissible, unreasonable or invalid interpretations of the claims of the Patents-in-Suit are interposed for the purposes of this suit and its anti-competitive effect.

71. ~~25.~~ On information and belief, Voith knew or should have known of existing prior art that was not before the United States Patent and Trademark Office during the prosecution of the applications leading to the Patents-in-Suit.

72. ~~26.~~ On information and belief, that existing prior art is such that Voith knew or should have known that the claims of the Patents-in-Suit were not patentable.

73. ~~27.~~ On information and belief, that existing prior art is such that Voith now knows or should have known that its interpretations of the claims of the Patents-in-Suit render them invalid.

74. ~~28.~~ On information and belief, Voith knowingly ignored the existing prior art so it could advance its impermissible, unreasonable or invalid

interpretations of the claims of the Patents-in-Suit and use them as a jurisdictional basis for this sham suit and its anti-competitive effects.

75. ~~29.~~—Voith's assertion of impermissible, unreasonable or invalid interpretations of the claims of the Patents-in-Suit is having an anti-competitive effect on JohnsonFoils.

RELIEF

WHEREFORE, JohnsonFoils requests that this Court enter a judgment that:

(a) Dismisses Voith's Complaint with prejudice and denies all of the relief it requested therein;

(b) Voith and all persons in active concert or participation with it are enjoined from threatening or charging JohnsonFoils, its suppliers, customers or distributors with infringement of U.S. Patent Nos. 5,538,206, 5,500,091, 5,853,544, 5,718,805 and 5,972,168;

(c) JohnsonFoils its suppliers, customers and distributors are not liable for any infringement of U.S. Patent Nos. 5,538,206, 5,500,091, 5,853,544, 5,718,805 and 5,972,168;

(d) That U.S. Patent Nos. 5,538,206, 5,500,091, 5,853,544, 5,718,805 and 5,972,168 are invalid, unenforceable, and void pursuant to 35 U.S.C. §§ 101 *et seq.*;

(e) That Voith is not entitled to costs pursuant to 35 U.S.C. § 288;

(f) Awards JohnsonFoils damages arising out of Voith's misuse of U.S. Patent Nos. 5,538,206, 5,500,091, 5,853,544, 5,718,805 and 5,972,168;

(g) This is an exceptional case entitling JohnsonFoils to an award of its attorneys' fees and costs pursuant to 35 U.S.C. § 285;

(h) That JohnsonFoils is entitled to prejudgment interest and post-judgment interest on the above damages awards; and

(i) Such other and further relief as this Court may deem appropriate.

JURY TRIAL DEMAND

A trial by jury is demanded.

Respectfully submitted,

Dated: _____

George H. Seitz, III (DE #667)
Seitz, Van Ogtrop & Green, P.A.
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P.O. Box 68
Wilmington, DE 19899
(302) 888-7602

Anthony S. Volpe
John J. O'Malley
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*Attorneys for Defendant
JohnsonFoils, Inc.*

EXHIBIT J

GREENBLUM & BERNSTEIN, P.L.C.

PATENT, COPYRIGHT AND TRADEMARK MATTERS

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December 18, 2007

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* ADMITTED TO A BAR
OTHER THAN VA
□ EUROPEAN PATENT ATTORNEY
Δ KOREAN PATENT ATTORNEY
□ REGISTERED PATENT AGENT

VIA EMAIL(PDF)

Tony Volpe, Esq.
Volpe and Koenig, P.C.
United Plaza, Suite 1600
30 South 17th Street
Philadelphia, PA 19103

Re: *Voith Paper GmbH & Co. KG v. JohnsonFoils, Inc.*
C.A. No. 07-0226-JJF. Our Ref.: 214720.

Dear Tony:

As you know, a Markman hearing is scheduled for next month. We propose that each side submit an opening Markman brief, an opposition, and a reply, and we would like to discuss a briefing schedule with you. Additionally, please let me know whether JohnsonFoils is agreeable to setting a time for each party to identify the claim terms which it asserts need to be construed by the Court. To the extent that we can agree on the meaning of any of those terms, it will narrow the issues to be resolved by the Court.

With respect to your request for leave to amend JohnsonFoils counterclaims, JohnsonFoils has already filed a separate action (C.A. No. 07-760) seeking exactly the same relief which you seek to include in the amended counterclaim. There is no proper justification to amend the counterclaims in the present action to simply repeat what is asserted in the other action, especially when JohnsonFoils has requested to stay this action. Moreover, the proposed amendment at this point in the litigation would unfairly prejudice Voith, cause unnecessary delay, and needlessly increase the cost of litigation, and as such, appears to be interposed for improper purposes. Accordingly, Voith does not consent to the request to amend.

Tony Volpe, Esq.

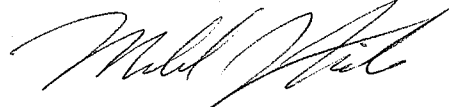
December 18, 2007

Page -2-

We can be available tomorrow if you are willing to discuss these matters.

Very truly yours,

GREENBLUM & BERNSTEIN, P.L.C.

A handwritten signature in black ink, appearing to read "Michael J. Fink", written in a cursive style.

Michael J. Fink

MJF/mis

EXHIBIT K

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

VOITH PAPER GMBH & CO. KG,)	
a Company organized and)	
existing under the laws of Germany,)	
)	
Plaintiff,)	
)	C.A. No. 07-0226-JJF
v.)	
)	
JOHNSONFOILS, INC.)	
a Delaware Corporation,)	
)	
Defendant.)	

PLAINTIFF'S FIRST SET OF INTERROGATORIES TO JOHNSONFOILS, INC.

Pursuant to Rule 33 of the Federal Rules of Civil Procedure, Plaintiff Voith Paper GmbH & Co. KG (hereinafter, "Plaintiff") requests that Defendant JohnsonFoils, Inc. (hereinafter, "Defendant") answers the following interrogatories separately, fully, and under oath, within thirty (30) days of service. In accordance with Federal Rule of Civil Procedure 26(e), Defendant is subject to a duty to seasonably amend all responses to these interrogatories. The following definitions and instructions apply, as do the definitions set forth in Local Rule 26.5(c).

DEFINITIONS

These interrogatories shall be deemed to be continuing within the meaning of Fed. R. Civ. P. 26 (e) (1) and (2) with respect to any additional information which becomes known to Defendant or its counsel up to and including the time of trial. Answers hereto shall be enlarged, diminished, or otherwise modified to include any information required by Fed. R. Civ. P. 26 (e) (1) and (2) as acquired by Defendant subsequent to the date of its initial answers within a reasonable time after the acquisition of such information.

The singular shall include the plural and *vice versa*, and words in any gender shall include the other gender.

The term “Patents-in-suit” means the patent that are the subject of the above-captioned matter, specifically including U.S. Pat. Nos. 5,718,805 and 5,972,168 (collectively hereinafter “the Patents-in-suit”).

The term “Prior Art” shall be construed in accordance with the meaning given that term in Title 35, United States Code, and interpretations thereof provided by the federal judiciary.

The term “Plaintiff” means Voith Paper GmbH & Co. KG

The term “Defendant” means JohnsonFoils, Inc.; any predecessor business organization of the Defendant, and any wholly or partly owned subsidiary, division, parent, joint venture, or other entity in which any or all of Defendant is a material participant or equity interest holder, or was a material participant or equity interest holder at any time.

The term “Person” means any individual or organization, including sole proprietorship, partnership, corporation, association, governmental body or agency, or other legal entity.

The term “Organization” means domestic or foreign, public or private corporations, partnerships or proprietorships, as well as all other business organizations, associations, forms, trustees, or legal entities.

The term “Document” means any medium, upon which information can be communicated, in the possession, custody or control of Defendant, its counsels or its consultants, or known to Defendant, its counsels or its consultants, and is used in a comprehensive sense to include, without limitation, the following items, whether printed, typed, written or produced by hand or stamp, recorded, microfilmed, photographed, video-

taped, filmed, stored on information storage means such as data bases, tapes, disks, hard drives, cassettes and/or other memory devices and computer records of any type, or any copy of Documents reproduced by any process, whether or not claimed to be privileged, confidential or personal: letters, notes, memoranda, reports, records, agreements, working papers, communications (including interdepartmental or intradepartmental communications, inter-company or intra-company communications), correspondence, summaries or records of personal conversations, diaries, e-mails, facsimile transmissions, forecasts, statistical statements, tables, graphs, laboratory reports, research reports, notebooks, books, charts, spreadsheets, plans, production files, blueprints, schematics, flow charts, computer programs, including source code and associated documentation both integral and separate from the program, engineering specifications, software specifications, diagrams, drawings, manuals, instructions and/or procedures, including, but not limited to, installation instructions or procedures, operating instructions or procedures, calibration instructions or procedures, maintenance or service instructions or procedures, photographs, minutes or records of meetings, minutes or records of conferences, expressions or statements of policy, lists of persons attending meetings or conferences, recorded statements, interviews or conversations, transcripts, reports or summaries of interviews, reports or summaries of investigations, opinions or reports or summaries of either negotiations or preparations for such, brochures, pamphlets, advertisements, circulars, press releases, price lists, instruments, accounts, bills of sale, purchase orders, quotations, terms of sale, invoices, lists of expenses, both fixed and variable, and all other materials on any tangible medium of expression, and all original and/or preliminary notes. Any comment or notation appearing on any Document, and not a part of the original text, is to be considered a separate "Document." Unless otherwise noted, the

Documents requested are those prepared or existing at the time that Defendant's Answer and Counterclaims were filed in the present action and those prepared since that time.

The terms "Identify" or "Identity," in the case of an individual, mean to state the person's full name; home address (present or last known); employer or business affiliation, business address and position; email address(es), and the relevant time period and nature of each of his present and prior employment positions or affiliations with Defendant.

The terms "Identify" or "Identity," in the case of an Organization, mean to state the organization's full name; type of organization (*i.e.*, corporation, partnership, etc.); the post office address of its principal place of business; date(s) and state(s) or country(ies) of incorporation; the identities of its principal officers and directors; and, any date of dissolution.

The terms "Identify" or "Identify," in the case of a Document, mean to state the Document's title and a description of its subject matter; the type or nature of the Document (*e.g.*, e-mail, letter, memorandum, telegram, chart, laboratory report, etc.); the identity of all person(s) who prepared the Document; the identity of all person(s) to whom copies were provided and/or submitted; the date the Document was prepared; its present location and custodian; and all other means of identifying it with sufficient particularity to satisfy the requirements for its inclusion in a demand or request for its production pursuant to Fed. R. Civ. P. 34.

The term "Identify" or "Identify," in the case of software, computer program, application, system, apparatus, device, component thereof, or other thing, means to describe the system or device, component or thing by name, model number, type, storage capacity, part number, and all other means of identifying it with sufficient particularity to satisfy the requirements for its inclusion in a demand or request for its production pursuant to Fed. R. Civ. P. 34.

In the event Defendant contends that any Document asked to be Identified is privileged or otherwise excludable from discovery, Defendant is requested to specify the basis for the privilege or other grounds for exclusion in addition to the Document Identification information requested above.

The term "Identify with Specificity," in addition to what is requested in the paragraphs above, means to Identify the responsive Documents by Bates number and to particularly point out the specific page(s), paragraph(s) and line(s) where the requested information can be found. In the case of a patent, in addition to the patent number, the specific column and line numbers should be provided.

The terms "Accused Product" and "Accused Products" as used herein means each and every paper forming machine which Defendant has modified, or contracted to modify, to utilize one or more resiliently supported blades.

The term "Client" as used herein means any and all Persons, and/or Organizations that is a client of Defendant in relation with the Accused Products.

The term "Customer" as used herein means any and all Persons, and/or Organizations that is a customer of Defendant in relation with the Accused Products.

INSTRUCTIONS

The form of the responses to this first set of interrogatories is to comply with Federal Rule 33(b) of the Federal Rules of Civil Procedure.

INTERROGATORIES

INTERROGATORY NO. 1:

Identify each and every paper forming machine which Defendant has modified, or contracted to modify, to utilize one or more resiliently supported blades.

INTERROGATORY NO. 2:

For each Accused Product, identify the make and model number of each paper forming machine which was modified, the specific modifications made to each such machine, the owner and location of each such machine, the dates when such modifications were made, and the person(s) most knowledgeable about the modifications made to each such machine.

INTERROGATORY NO. 3:

Identify the Person(s) most knowledgeable about the design, development and/or functionality of the Accused Products.

INTERROGATORY NO. 4:

Identify any and all Clients to whom the Accused Products have been offered, sold, licensed, or otherwise made available.

INTERROGATORY NO. 5:

For each of the Affirmative Defenses and Counterclaims asserted or which will be asserted, identify and specifically describe all facts on which you rely to support those contentions, and identify the Person(s) most knowledgeable about the facts and all documents in support thereof.

INTERROGATORY NO. 6:

Identify the Prior Art which you contend is relevant and/or material to the Patents-in-suit, specify each claim to which each piece of Prior Art relates, describe with particularity why such Prior Art reference is material, i.e. identify with specificity each claim element in the Patents-in-suit which the Prior Art discloses, and why such Prior Art reference is not cumulative over the Prior Art of record considered by the examiner, i.e., identify with specificity the claim elements or combination of claim elements that the Prior Art of record

allegedly does not disclose, and state how you contend this Prior Art is applied against each of those claims.

INTERROGATORY NO. 7:

For each claim of each of the Patents-in-suit which Defendant asserts is not infringed by the Accused Products, for each Accused Product, identify each claim limitation which Defendant asserts is not literally present in the Accused Product and describe why the claim is not infringed under the doctrine of equivalents.

INTERROGATORY NO. 8:

For each and every paper forming machine which Defendant has modified to utilize one or more resiliently supported blades, identify the amount charged for the modification and all documents relating thereto.

INTERROGATORY NO. 9:

Identify all Persons whom will be called as witnesses to present testimony at deposition and/or at trial, and state the substance and basis(es) of their testimony.


INTERROGATORY NO. 10:

Identify all Documents that you intend to present at trial and/or hearing.

INTERROGATORY NO. 11:

Identify the individual(s) who are providing the answers to these Interrogatories and the responses to Plaintiff's First Request for Production of Documents submitted herewith.

Dated: July 26, 2007


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(302) 571-6642

Attorneys for Voith Paper GmbH & Co. KG

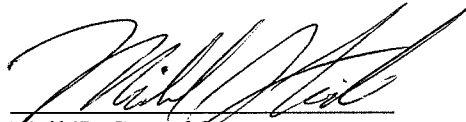
CERTIFICATE OF SERVICE

I hereby certify that a copy of the PLAINTIFF'S FIRST SET OF INTERROGATORIES TO JOHNSONFOILS, INC. was served on Attorneys for Defendant JohnsonFoils, Inc., via Electronic Mail and First Class Mail:

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Date: July 26, 2007



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Attorneys for Plaintiff Voith Paper GmbH & Co. KG

EXHIBIT L

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

VOITH PAPER GMBH & CO. KG,)	
a Company organized and)	
existing under the laws of Germany,)	
)	
Plaintiff,)	
)	C.A. No. 07-0226-JJF
v.)	
)	
JOHNSONFOILS, INC.)	
a Delaware Corporation,)	
)	
Defendant.)	

**PLAINTIFF'S FIRST SET OF REQUESTS FOR PRODUCTION
TO JOHNSONFOILS, INC.**

Pursuant to Rule 34 of the Federal Rules of Civil Procedure, Plaintiff Voith Paper GmbH & Co. KG (hereinafter, "Plaintiff") requests that Defendant JohnsonFoils, Inc. (hereinafter, "Defendant") produces for inspection and copying all of the following documents and other tangible things that are in its possession, custody, or control. Production shall take place within thirty (30) days of this request, at the offices of Greenblum & Bernstein, P.L.C., 1950 Roland Clarke Place, Reston, Virginia 20191, or at such other location and time as the parties agree. In accordance with Federal Rule of Civil Procedure 26(e), Defendant is subject to a duty to seasonably amend all responses to these requests for production. The following definitions and instructions apply.

DEFINITIONS

Plaintiff incorporates by reference the Definitions contained in Plaintiff's First Set of Interrogatories served concurrently herewith.

INSTRUCTIONS

A. If the requested Document, material, thing, and/or information exists on computer media form, it must be produced as computer media rather than being printed out.

B. If Defendant knows of the existence, past or present, of any Documents or things requested below, but is unable to produce such Documents or things because they are not presently in the possession, custody, or control of Defendant, Defendant shall so state and shall identify such Documents or things, and the Person who has possession, custody, or control of the Documents or things.

C. If any Document is known to have existed and cannot now be located or has been either destroyed or discarded, that Document shall be identified by the last known person(s) who had custody of the Document, the date of the destruction or discard, the manner(s) the Document has been destroyed or discarded, the reason(s) for destruction or discard, the efforts and action(s) made to locate the Document if lost or misplaced, a statement describing the Document, including, but not limited to a summary of its contents, the identity and position or title of its author(s) and of all persons to whom it was sent and/or shown.

D. If Defendant declines to produce any Documents, or thing under the claim of privilege or other objection, it shall identify each such Document or thing by its date, nature, author and addressee if applicable, as well as identify all recipients thereof, and state the name and address of the person in possession of the Document, or the thing by its date, nature, subject matter, the number of pages, attachments or appendices, author and addressee if applicable, position or title of the author(s) and of the addressee(s) if applicable, as well as identify all recipients thereof, such as but not limited to all persons to whom distributed, shown or explained, and state the name and address of the person in possession of the Document, or the thing. Further, Defendant shall state, in compliance with the Protected

Order, the privilege on which it relies in declining to produce the Document and the basis for the claim of privilege or other basis upon which they decline to produce the Document and/or the thing.

E. Documents from any single file should be produced in the same order as they were found in this file, and the files from which they are being produced shall be identified. If copies of Documents are produced in lieu of the originals, such copies must be legible and bound or stapled in the same way then the originals.

F. As to each Document and/or thing produced in response hereto, Defendant shall identify the request for production and where applicable, the interrogatory number, in response to which the Document or thing is being produced.

G. The requests set forth herein shall be deemed continuing pursuant to Fed. R. Civ. P. 26 (e) (1) and (2) so as to require supplemental production of documents and/or things if Defendant discovers responsive Documents and/or things after the date of response hereto despite a diligent effort to provide all responsive Documents within the time specified by Fed. R. Civ. P. 34.

REQUESTS FOR PRODUCTION

REQUEST FOR PRODUCTION NO. 1:

All agreements and/or contracts relating to the sale, offer for sale, use, importation, or otherwise making available the Accused Products.

REQUEST FOR PRODUCTION NO. 2:

All Documents relating to or referring to any agreements and/or contracts relating to the sale, offer for sale, use importation, or otherwise making available the Accused Products.

REQUEST FOR PRODUCTION NO. 3:

All Documents (whether in paper or electronic format) referring or relating to, evidencing, showing in particular, but not limited to, the structure, function, or operation of any version of the Accused Products, including but not limited to patent applications, notes, correspondence, memoranda, reports, evaluations, surveys, studys, presentations, technical lectures, talks, prototypes, samples, advertisements, marketing materials, contracts and agreements such as, without limitation, those relating to venture capital, user guides, product literature, preparatory works, drawings, development documentation, product documentation, and maintenance documentation, referring or relating to, evidencing, showing the structure, function, or operation of any version of the Accused Products.

REQUEST FOR PRODUCTION NO. 4:

All Documents relating to internal and/or external complaints, problems, comments, evaluations, survey, analysis, studies or reports regarding the Accused Products.

REQUEST FOR PRODUCTION NO. 5:

All Documents describing, referring or relating to in whole or in part to differences, similarities and/or comparisons between the Accused Product, and either or both of the Patents-in-suit and/or Plaintiff's product(s).

REQUEST FOR PRODUCTION NO. 6:

All Documents, things, and material relating to the design and/or development of all versions of the Accused Products or part thereof, and all Documents, things, and material sufficient to identify all Persons who participated in such design and/or development.

REQUEST FOR PRODUCTION NO. 9:

All Documents, searches, studies, opinions, or evaluations made in connection with either or both of the Patents-in-suit, and all documents referring or relating to such searches,

studies, opinions, or evaluations including but not limited to issues of novelty, patentability, validity, enforceability, or enforceable scope of either or both of the Patents-in-suit.

REQUEST FOR PRODUCTION NO. 10:

All Documents concerning the data and/or other information created, viewed or considered by any expert preparing a report or affidavit on behalf of Defendant, in forming his or her opinion.

REQUEST FOR PRODUCTION NO. 11:

All Documents and things referring to or relating to specifications of any Accused Product, including but not limited to marketing requirements, design requirements, functional specifications, detailed design descriptions, test plans, and any other technical or marketing requirements.

REQUEST FOR PRODUCTION NO. 12:

All Documents and things referring to or relating to market or technical research, any studies, patent searches, and/or prior art searches undertaken by the Defendant, or done on Defendant's behalf, including but not limited to materials and information gathered about either or both of the Patents-in-suit or Plaintiff's product(s).

REQUEST FOR PRODUCTION NO. 13:

All Documents referring to or relating to Defendant first becoming aware of either or both of the Patents-in-suit.

REQUEST FOR PRODUCTION NO. 14:

All Documents and things referring to or relating to Defendant's marketing plans, goals and strategies with respect to the Accused Products.

REQUEST FOR PRODUCTION NO. 15:

All Documents and things referring to or relating to Defendant's marketing of the Accused Products, including but not limited to all promotions, demonstrations, presentations, promotional materials and/or offers for sale, licensing and otherwise making the Accused Products available.

REQUEST FOR PRODUCTION NO. 16:

All Documents which refer to or reference Plaintiff and/or Plaintiff's products.

REQUEST FOR PRODUCTION NO. 17:

All Documents and things referring to or relating the Defendant selling, importing, licensing or otherwise making available the Accused Products, including but not limited to any and all proposals, orders, contracts, agreements, and/or invoices.

REQUEST FOR PRODUCTION NO. 18:

All Documents and things illustrating, referring to or relating to Defendant's prices associated with the Accused Products.

REQUEST FOR PRODUCTION NO. 19:

All Documents that refer or relate to any sales and/or contracts concerning the Accused Products, including but not limited to communications with potential and/or actual customers.

REQUEST FOR PRODUCTION NO. 20:

All agreements entered into by the Defendant referring to or relating to installation, maintenance, service and/or warranty of any of the Accused Products.

REQUEST FOR PRODUCTION NO. 21:

All Documents and things referring to or relating to the respective gross and/or net profit, sales, costs and/or expenses realized on and/or in relation to the selling, leasing,

licensing, and/or otherwise commercializing the Accused Products, and a breakdown of such income by Accused Product, on a yearly basis, for every year, from 2001 to present.

REQUEST FOR PRODUCTION NO. 23:

All Documents generated by or on behalf of Defendant or any third party referring to or relating to the Plaintiff and/or Plaintiff's products, including but not limited to communications between Defendant and any third party, press releases, news articles, abstracts, conference papers, advertisements and/or promotional materials.

REQUEST FOR PRODUCTION NO. 24:

All Documents and things which concern, analyze, refer and/or relate to any of the Accused Products, whether internal or external communications, to or from Defendant, including but not limited to communications between and among the respective board members, officers, employees, staff members, attorneys, agents or representatives.

REQUEST FOR PRODUCTION NO. 25:

All Documents and things illustrating, referring to or relating to the past and present structure and organization of Defendant, including but not limited to organizational charts, incorporation documents and office location(s), any transfer of assets (such as technology, intellectual property rights), or change of corporate name.

REQUEST FOR PRODUCTION NO. 26:

All Documents concerning or in relation to Defendant's document retention, custody, and/or destruction policy(ies) from 2001 to present.

REQUEST FOR PRODUCTION NO. 27:

All Prior Art on which Defendant relies or intends to rely to support claims of invalidity of any of the Patents-in-suit, including but not limited to all Prior Art cited in any opinions and studies regarding the either or both of the Patents-in-suit.

REQUEST FOR PRODUCTION NO. 28:

All Documents that refer to, relate to, support or refute Defendant's contentions and belief that it has not infringed and is not infringing the Patents-in-suit.

REQUEST FOR PRODUCTION NO. 29:

All Documents that refer to, relate to, support or refute Defendant's contentions and belief that it has not contributed to infringement and has not induced others to infringe, and is not now contributing to infringement nor inducing others to infringe, either or both of the Patents-in-suit.

REQUEST FOR PRODUCTION NO. 30:

To the extent not produced in response to another Request For Production, all Documents which support any defense asserted by Defendants.

REQUEST FOR PRODUCTION NO. 31.

All Documents on which Defendant intends to rely at trial or hearing within this litigation.

REQUEST FOR PRODUCTION NO. 32:

All Documents passing between Defendant and any person that Defendant may call as a witness at trial or hearing within this litigation.

REQUEST FOR PRODUCTION NO. 33.

All Documents and things required to be identified by Fed. R. Civ. P. 26(a) (1).

REQUEST FOR PRODUCTION NO. 34:

All Documents, things, and materials requested to be identified in Plaintiff's First Set of Interrogatories served concurrently herewith.

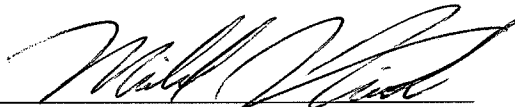
REQUEST FOR PRODUCTION NO. 35:

All Documents, things, and materials identified and/or containing information used in preparing Defendant's responses to Plaintiff's First Set of Interrogatories served concurrently herewith.

REQUEST FOR PRODUCTION NO. 36:

All Documents and things relating to any attempts to design around any claim(s) of either or both of the Patents-in-suit.

Dated: July 26, 2007



GREENBLUM & BERNSTEIN, P.L.C.

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Wilmington, Delaware 19899

(302) 571-6642

Attorneys for Voith Paper GmbH & Co. KG

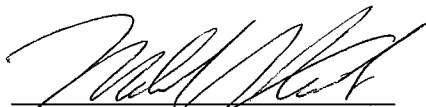
CERTIFICATE OF SERVICE

I hereby certify that a copy of the PLAINTIFF'S FIRST SET OF REQUESTS FOR PRODUCTION TO JOHNSONFOILS, INC. was served on Attorneys for Defendant JohnsonFoil, Inc., via Electronic Mail and First Class Mail:

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Date: July 26, 2007



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– and –

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Attorneys for Plaintiff Voith Paper GmbH & Co. KG

EXHIBIT M

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

VOITH PAPER GMBH & CO. KG,)	
a Company organized and)	
existing under the laws of Germany,)	
)	
Plaintiff,)	
)	C.A. No. 07-0226-JJF
v.)	
)	
JOHNSONFOILS, INC.)	
a Delaware Corporation,)	
)	
Defendant.)	

**PLAINTIFF'S SECOND SET OF
REQUESTS FOR PRODUCTION TO JOHNSONFOILS, INC.**

Pursuant to Rule 34 of the Federal Rules of Civil Procedure, Plaintiff Voith Paper GmbH & Co. KG (hereinafter, "Plaintiff") requests that Defendant JohnsonFoils, Inc. (hereinafter, "Defendant") produces for inspection and copying all of the following documents and other tangible things that are in its possession, custody, or control. Production shall take place within thirty (30) days of this request, at the offices of Greenblum & Bernstein, P.L.C., 1950 Roland Clarke Place, Reston, Virginia 20191, or at such other location and time as the parties agree. In accordance with Federal Rule of Civil Procedure 26(e), Defendant is subject to a duty to seasonably amend all responses to these requests for production. The following definitions and instructions apply.

DEFINITIONS

Plaintiff incorporates by reference the Definitions contained in Plaintiff's Second Set of Interrogatories served concurrently herewith.

INSTRUCTIONS

A. If a requested Document, material, thing and/or any information exists on computer media, it must be produced on computer media. If a requested Document, material, thing and/or any information exists both on computer media and some other form, each other form of the Document, material, thing and/or information must be produced in addition to the computer media form if it is not identical to the computer media form with respect to both content and properties, including without limitation the presence of annotations or the Document's legibility.

B. If Defendant knows of the existence, past or present, of any Documents or things requested below, but is unable to produce such Documents or things because they are not presently in the possession, custody, or control of Defendant, Defendant shall so state and shall identify such Documents or things, and the Person who has possession, custody, or control of the Documents or things with sufficient information to identify the requested document, thing, and/or information and the person or entity having said possession, custody, or control, to satisfy the requirements for a request to production of the document, thing and/or information from said third parties pursuant to Fed. R. Civ. P. 34(c) and Fed. R. Civ. P. 45.

C. If any Document is known to have existed and cannot now be located or has been either destroyed or discarded, that Document shall be identified by the last known person(s) who had custody of the Document, the date of the destruction or discard, the manner(s) in which the Document has been destroyed or discarded, the reason(s) for the destruction or discard, the efforts and action(s) made to locate the Document if lost or misplaced, a statement describing the Document, including, but not limited to a summary of its contents,

the identity and position or title of its author(s) and of all persons to whom it was sent and/or shown.

D. If Defendant declines to produce any Documents, or thing under the claim of privilege or other objection, it shall identify each such Document or thing by its date, nature—including information sufficient to establish that nondisclosure is warranted under the asserted privilege or objection, including without limitation a disclosure of any nonprivileged information contained in the document—author and addressee if applicable, as well as identify all recipients thereof, and state the name and address of the person in possession of the Document, or the thing by its date, nature, subject matter, the number of pages, attachments or appendices, author and addressee if applicable, position or title of the author(s) and of the addressee(s) if applicable, as well as identify all recipients thereof, such as but not limited to all persons to whom distributed, shown or explained, and state the name and address of the person in possession of the Document, or the thing. Further, Defendant shall state, in compliance with the Federal Rules and any protective order entered in this case, the privilege on which it relies in declining to produce the Document and the basis for the claim of privilege or other basis upon which they decline to produce the Document and/or the thing.

E. Documents from any single file should be produced in the same order as they were found in this file, and the files from which they are being produced shall be identified. If copies of Documents are produced in lieu of the originals, such copies must be legible and bound or stapled in the same way then the originals. If a copy of a file is produced in the manner in which it is maintained in the ordinary course of business, the original file must be made available for inspection upon request.

F. As to each Document and/or thing produced in response hereto, Defendant shall identify the request for production and where applicable, the interrogatory number, in

response to which the Document or thing is being produced. In addition, Defendant shall designate the source of each document, including the name and contact information of the individual in possession, custody or control of the document as it is maintained in the ordinary course of business.

G. The requests set forth herein shall be deemed continuing pursuant to Fed. R. Civ. P. 26 (e) (1) and (2) so as to require supplemental production of documents and/or things if Defendant discovers responsive Documents and/or things after the date of response hereto despite a diligent effort to provide all responsive Documents within the time specified by Fed. R. Civ. P. 34.

REQUESTS FOR PRODUCTION

REQUEST FOR PRODUCTION NO. 37:

All Documents, including, but not limited to, agreements and/or contracts relating to the sale, offer for sale, use, importation, or otherwise making available any paper forming machine which is being modified, is planned to be modified, or is offered to be modified to include at least one resiliently mounted blade.

REQUEST FOR PRODUCTION NO. 38:

All Documents describing, referring or relating to in whole or in part to differences, similarities and/or comparisons between any paper forming machine which is being modified, is planned to be modified, or is offered to be modified to include with at least one resiliently mounted blade and either or both of the Patents-in-Suit and/or Plaintiff's product(s).

REQUEST FOR PRODUCTION NO. 39:

All Documents, things, and material relating to the design and/or development of all versions of any paper forming machine which is being modified, is planned to be modified, or is offered to be modified to include at least one resiliently mounted blade, or part of such

paper forming machine thereof, and all Documents, things, and material sufficient to identify all Persons who participated in such design and/or development.

REQUEST FOR PRODUCTION NO. 40:

All Documents and things referring to or relating to specifications of any paper forming machine which is being modified, is planned to be modified, or is offered to be modified to include at least one resiliently mounted blade, including but not limited to marketing requirements, design requirements, functional specifications, detailed design descriptions, test plans, and any other technical or marketing requirements.

REQUEST FOR PRODUCTION NO. 41:

All Documents and things referring to or relating to Defendant's marketing plans, goals, and/or strategies with respect to any paper forming machine having at least one resiliently mounted blade.

REQUEST FOR PRODUCTION NO. 42:

All Documents and things referring to or relating to Defendant's marketing of any paper forming machine having at least one resiliently mounted blade, including but not limited to all promotions, demonstrations, presentations, promotional materials and/or offers for sale, licensing and otherwise making such a paper forming machine available.

REQUEST FOR PRODUCTION NO. 43:

All Documents and things referring to or relating the Defendant selling, importing, licensing or otherwise making available a paper forming machine with at least one resiliently mounted blade, including but not limited to any and all proposals, orders, contracts, agreements, and/or invoices.

REQUEST FOR PRODUCTION NO. 44:

All Documents and things illustrating, referring to or relating to Defendant's prices associated with any paper forming machine with at least one resiliently mounted blade.

REQUEST FOR PRODUCTION NO. 45:

All Documents that refer or relate to any sales and/or contracts concerning paper forming machines having at least one resiliently mounted blade, including but not limited to communications with potential and/or actual customers.

REQUEST FOR PRODUCTION NO. 46:

All Documents and things which concern, analyze, refer and/or relate to any paper forming machine having at least one resiliently mounted blade, whether internal or external communications, to or from Defendant, including but not limited to communications between and among the respective board members, officers, employees, staff members, attorneys, agents or representatives.

REQUEST FOR PRODUCTION NO. 47:

All Documents reviewed and/or relied upon by any person that Defendant may call as a witness at trial or any hearing in this litigation.

REQUEST FOR PRODUCTION NO. 48:

All Documents, things, and/or materials requested to be identified by any Plaintiff interrogatory.

REQUEST FOR PRODUCTION NO. 49:

All Documents, things, and materials identified and/or containing information used in preparing Defendant's responses to any Plaintiff interrogatory.

REQUEST FOR PRODUCTION NO. 50:

All documents and things relating to, supporting, or contradicting your claim that “JohnsonFoils has not infringed any claim of the Patents-in-Suit, either literally or under the doctrine of equivalents.”

REQUEST FOR PRODUCTION NO. 51:

All documents and things relating to, supporting, or contradicting your claim that “[e]ach of the Patents-in-Suit is invalid, unenforceable, and void for failure to comply with the provisions of 35 U.S.C. § 101 et seq.”

REQUEST FOR PRODUCTION NO. 52:

All documents and things relating to, supporting, or contradicting your claim that “Voith is barred by the doctrine of prosecution history estoppel from presenting a claim interpretation necessary to find infringement of any claim of the Patents-in-Suit.”

REQUEST FOR PRODUCTION NO. 53:

All documents and things relating to, supporting, or contradicting your claim that “Voith has misused each of the Patents-in-Suit which renders each of them unenforceable, and Voith is precluded from obtaining any relief in this action due to its misuse.”

REQUEST FOR PRODUCTION NO. 54:

All documents and things relating to, supporting, or contradicting your claim that “Voith's claims are barred, in whole or in part, by the [doctrine of equitable estoppel, the doctrine of waiver, the statute of limitations, and the doctrine of laches].”

REQUEST FOR PRODUCTION NO. 55:

All documents and things relating to, supporting, or contradicting your claim that “JohnsonFoils has not induced and is not inducing infringement of any claim of the Patents-

in-Suit,” and “JohnsonFoils has not in the past and is not now contributing to the infringement of any claim of the Patents-in-Suit.”

REQUEST FOR PRODUCTION NO. 56:

All documents and things relating to, supporting, or contradicting your claim that “[a]ll claims of the Patents-in-Suit are invalid under 35 U.S.C. § 102.”

REQUEST FOR PRODUCTION NO. 57:

All documents and things relating to, supporting, or contradicting your claim that “[a]ll claims of the Patents-in-Suit are invalid under 35 U.S.C. § 103.”

REQUEST FOR PRODUCTION NO. 58:

All documents and things relating to, supporting, or contradicting your claim that “[a]ll claims of the Patents-in-Suit are invalid under 35 U.S.C. § 112.”

REQUEST FOR PRODUCTION NO. 59:

All documents and things relating to, supporting, or contradicting your claim that “Voith knew or should have known that JohnsonFoils was not infringing any permissible, reasonable, or valid interpretation of any claim of the Patents-in-Suit” and that “Voith's . . . interpretations of the claims of the Patents-in-Suit are interposed for . . . anti-competitive effect.”

REQUEST FOR PRODUCTION NO. 60:

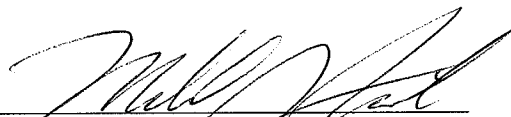
All documents and things relating to, supporting, or contradicting your claim that “Voith knew or should have known of existing prior art that was not before the United States Patent and Trademark Office during the prosecution of the applications leading to the Patents-in-Suit,” “that existing prior art is such that Voith knew or should have known that the claims of the Patents-in-Suit were not patentable,” “that existing prior art is such that Voith now knows or should have known that its interpretations of the claims of the Patents-in-Suit render

them invalid,” “Voith knowingly ignored the prior art so it could advance its . . . interpretations of the claims . . . for anti-competitive effects,” and “Voith's assertion of . . . interpretations of the claims of the Patents-in-Suit is having an anti-competitive effect on JohnsonFoils.”

REQUEST FOR PRODUCTION NO. 61:

All documents and things relating to any communications between Defendant and others about this litigation.

Dated: August 16, 2007



GREENBLUM & BERNSTEIN, P.L.C.
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(302) 571-6642

Attorneys for Voith Paper GmbH & Co. KG

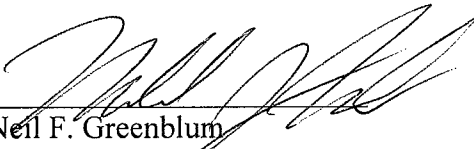
CERTIFICATE OF SERVICE

I hereby certify that a copy of the PLAINTIFF'S SECOND SET OF REQUESTS FOR PRODUCTION TO JOHNSONFOILS, INC. was served on Attorneys for Defendant JohnsonFoil, Inc., via Electronic Mail and First Class Mail:

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Randolph J. Huis, Esq.
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Date: August 16, 2007



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(302) 571-6642

Attorneys for Plaintiff Voith Paper GmbH & Co. KG

EXHIBIT N

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE**

VOITH PAPER GMBH & CO. KG,
a Company organized and existing under
the laws of Germany,

Plaintiff,

v.

JOHNSONFOILS, INC.,
a Delaware Corporation,

Defendants.

Civil Action No. 07-0226-JJF

**DEFENDANT, JOHNSONFOILS, INC.'S FIRST SET OF REQUESTS FOR
PRODUCTION OF DOCUMENTS AND THINGS TO PLAINTIFF**

Defendant, Johnsonfoils, Inc., by and through its undersigned attorneys, hereby serves Plaintiff, Voith Paper GMBH & Co. KG, with the following Interrogatories Pursuant to Rules 26 and 33 of the Federal Rules of Civil Procedure.

DEFINITIONS

As used herein, the following definitions apply:

1. "Plaintiff" means "Voith Paper GMBH & Co. KG," and includes any and all agents or affiliates or predecessors in interest, business entities, officers, directors, employees or others who have in the past or now act for or on behalf of Plaintiff.

2. "Defendant" means "Johnsonfoils, Inc." and includes any and all agents or affiliates or predecessors in interest, business entities, officers, directors, employees or others that Plaintiff believes is or was in privity with Defendant.

3. As used herein, “person” or “persons” means any natural person and all legal entities.

4. The term "document" is used in the broadest sense of Rule 34 of the Federal Rules of Civil Procedure and it includes things or physical objects regardless of how they were generated or maintained.

5. As used herein, the terms “and” and “or” shall be construed disjunctively or conjunctively as necessary in order to bring within the scope of the request all responses which might otherwise be construed to be outside of its scope.

6. As used in herein, the term “Complaint” means the Complaint filed by Plaintiff in Civil Action No. 07-0226-JJF.

7. As used herein, the “805 Patent” refers to U.S. Patent No. 5,718,805 and any related application or patent anywhere in the world.

8. As used herein, the “168 Patent” refers to U.S. Patent No. 5,972,168 and any related application or patent anywhere in the world.

9. As used herein, "Patents-in-Suit" both the '805 Patent and '168 Patent and any related application or patent anywhere in the world.

10. As used herein, "Applicant" includes any person named as an inventor of the '805 or '168 Patent and any related application or patent anywhere in the world.

DOCUMENT REQUESTS

REQUEST NO. 1:

All documents describing Plaintiff's organizational structure as it relates to the research, development, manufacturing, testing, marketing, exportation, importation, distribution, sale, and licensing of subject matter Plaintiff contends is covered by any claim of the Patents-in-Suit.

REQUEST NO. 2:

All documents concerning Plaintiff's procedures and policies for generating, maintaining, and disposing of records (regardless of how they were generated or maintained), including, but not limited documents related to the subject matter of the Patents-in-Suit.

REQUEST NO. 3:

All documents establishing Plaintiff's alleged investment in the subject matter of the Patents-in-Suit.

REQUEST NO. 4:

All documents establishing Plaintiff's alleged sales associated with the subject matter of the Patents-in-Suit.

REQUEST NO. 5:

All documents establishing Plaintiff's alleged costs associated with the subject matter of the Patents-in-Suit.

REQUEST NO. 6:

All documents establishing Plaintiff's alleged profits associated with the subject matter of the Patents-in-Suit.

REQUEST NO. 7:

All documents establishing Plaintiff's alleged revenue associated with licenses or sublicenses of the subject matter of the Patents-in-Suit.

REQUEST NO. 8:

All Applicant generated documents associated with or related to the subject matter of the Patents-in-Suit.

REQUEST NO. 9:

All Applicant maintained files associated with or related to the subject matter of the Patents-in-Suit.

REQUEST NO. 10:

All prior art known to Applicant to be associated with or related to the subject matter of the Patents-in-Suit.

REQUEST NO. 11:

All design, installation and manufacturing documentation in Applicant files associated with or related to the subject matter of the Patents-in-Suit.

REQUEST NO. 12:

All documents associated with or related to Plaintiff's evaluation of any potential infringement by Defendant of the subject matter of the Patents-in-Suit.

REQUEST NO. 13:

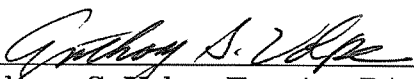
All documents associated with or related to Plaintiff's evaluation of any potential infringement by any third party of the subject matter of the Patents-in-Suit.

REQUEST NO. 14:

All documents that Plaintiff contends support or tend to support the Complaint allegations.

Respectfully submitted,

Date: 8/13/07

By 
Anthony S. Volpe, Esquire, PA # 24,733
Randolph J. Huis, Esquire, PA # 64,457
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Attorneys for Defendant, Johnsonfoils, Inc.

IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

VOITH PAPER GMBH & CO. KG,
A Company organized and existing
under the laws of Germany,

Plaintiff,

Y.

JOHNSONFOILS, INC.,
A Delaware Corporation,

Defendant.

C.A. No. 07-226-JJF

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing Defendant, Johnsonfoils, Inc.'s First Set of Requests For Production of Documents and Things to Plaintiff was served by first class mail on the following:

Adam W. Poff, Esquire
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Wilmington, DE 19899-0391

Michael J. Fink, Esquire
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1950 Roland Clarke Place
Reston, VA 20191

Respectfully submitted,

Date: 8/13/07

By Anthony S. Volpe
Anthony S. Volpe, Esquire, PA # 24,733
Randolph J. Huis, Esquire, PA # 64,457
Ryan W. O'Donnell, Esquire, PA # 89,775
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Attorneys for Defendant, Johnsonfoils, Inc.